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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): ROITMAN ET AL.

Serial No.: 10/824,548

Examiner: M. J. YU

Filing Date: April 14, 2004

Group Art Unit: 1641

Title: SURFACE-ENHANCED RAMAN SPECTROSCOPY FOR BIOSENSOR SYSTEMS AND METHODS  
FOR DETERMINING THE PRESENCE OF BIOMOLECULES

COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria VA 22313-1450

TRANSMITTAL OF APPEAL BRIEF

Sir:

Transmitted herewith is the Appeal Brief in this application with respect to the Notice of Appeal filed on April 3, 2006

The fee for filing this Appeal Brief is (37 CFR 1.17(c)) **\$500.00**.

(complete (a) or (b) as applicable)

The proceedings herein are for a patent application and the provisions of 37 CFR 1.136(a) apply.

☒ (a) Applicant petitions for an extension of time under 37 CFR 1.136 (fees: 37 CFR 1.17(a)(1)-(5)) for the total number of months checked below:

<input type="checkbox"/>	one month	\$ 120.00
<input type="checkbox"/>	two months	\$ 450.00
<input checked="" type="checkbox"/>	three months	\$1020.00
<input type="checkbox"/>	four months	\$1590.00

☐ The extension fee has already been filled in this application.

☐ (b) Applicant believes that no extension of term is required. However, this conditional petition is being made to provide for the possibility that applicant has inadvertently overlooked the need for a petition and fee for extension of time.

Please charge to Deposit Account **50-1078** the sum of **\$1520.00**. At any time during the pendency of this application, please charge any fees required or credit any overpayment to Deposit Account **50-1078** pursuant to 37 CFR 1.25.

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☒ I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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☐ I hereby certify that this paper is being facsimile transmitted to the Patent and Trademark Office on the date shown below.

Date of Facsimile:

Typed Name: Kay Fahland

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Respectfully submitted,

ROITMAN ET AL.

By

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Date: Sept 5, 2006

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S/N 10/824,548

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Roitman, Daniel	Examiner:	Yu, Melanie J.
Serial No.:	10/824,548	Group Art Unit:	1641
Filed:	April 14, 2004	Docket No.:	10030531-1 (14775.26US01)
Customer No.:	22878	Confirmation No.:	6420
Title:	Surface-Enhanced Raman Spectroscopy for Biosensor Systems and Methods for Determining the Presence of Biomolecules		

CERTIFICATE UNDER 37 CFR 1.8:

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail, with sufficient postage, in an envelope addressed to: Mail Stop APPEAL BRIEF - PATENTS, on 9-5-06.

By: Kay Fahland

Name: Kay Fahland



**APPEAL BRIEF**

Mail Stop Appeal Brief - Patents  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Dear Sir:

Applicants respectfully present this Appeal Brief in support of the Notice of Appeal filed on April 3, 2006, from the final rejection of Claims 1-9 of the above-identified application, as set forth in the Final Office Action mailed December 2, 2005.

Please charge Deposit Account No. 50-1078 in the amount of \$500.00 to cover the required fee filing of this Appeal Brief.

A Table of Contents is provided on page 2.

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## **I. REAL PARTY OF INTEREST**

The Real Party of Interest is Agilent Technologies, Inc.



## **II. RELATED APPEALS AND INTERFERENCES**

None.

### **III. STATUS OF CLAIMS**

1. Rejected
2. Rejected
3. Rejected
4. Rejected
5. Rejected
6. Rejected
7. Rejected
8. Rejected
9. Rejected
- 10–25. Cancelled

#### **IV. STATUS OF AMENDMENTS**

An amendment was filed in response to the Final Office Action of December 2, 2005. However, this amendment was not entered, and an Advisory Action was mailed on March 7, 2006. A Notice of Appeal was subsequently filed on April 3, 2006. The pending claims were last amended on September 30, 2005, in response to the non-final Office Action mailed March 9, 2005.

## **V. SUMMARY OF CLAIMED SUBJECT MATTER**

Briefly, Appellants' invention is to biosensors, systems and methods for detecting biomolecules using surface-enhanced Raman spectroscopy (SERS). Prior to Appellant's invention, SERS had been used for analysis of numerous chemicals and biochemicals, but the techniques failed to provide quantitative measurements with reproducible results. Appellants recognized for the first time that reproducible and quantitative/qualitative detection of a target biomolecule is possible, by associating detector nanoparticles with the target biomolecule.

The pending claims include one independent claim, and eight claims that depend therefrom, as summarized below. Where applicable, citation to portions of the supporting description found in the specification is provided for benefit of the Board.

**Claim 1** is directed to a method for determining the presence of a biomolecule using SERS, comprising electrochemically forming a detector complex on a conductive substrate. The detector complex includes a target biomolecule, a target nanoparticle, and a detector nanoparticle, with the detector nanoparticle disposed on the target nanoparticle, which is itself disposed on the target biomolecule. The biomolecule is disposed on the conductive substrate. A laser is directed at the detector complex, producing a SERS signal specific to the target biomolecule. Detection of the SERS signal indicates the presence of the biomolecule.

**Claims 2 and 3** are directed to the electrochemical formation of the detector complex on the conductive substrate. **Claim 2** recites forming a target complex between the target biomolecule and the target nanoparticle, and disposing the target complex on the conductive substrate. **Claim 3** recites disposing the target biomolecule on the conductive substrate, and contacting the target biomolecule with the target nanoparticle to form the target complex. **Claim 4** provides that the target nanoparticles are gold nanoparticles, while **Claim 5** provides that the detector nanoparticles are silver nanoparticles. **Claims 6 and 7** are directed to the electrochemical formation of the detector complex on the conductive substrate. **Claim 6** provides that the detector complex is formed by applying a voltage to the conductive support. **Claim 7** provides that the first detector is formed by contacting the conductive substrate to a foreign conductive structure, to cause reduction of the detector nanoparticle onto the target nanoparticle. Claims 8 and 9 are directed to the attachment of a marker molecule, to either the target biomolecule (claim 8) or the target nanoparticle (claim 9). An applicable general method of

biomolecule detection is presented on page 6 (at [0017]–[0018]), with a more detailed description provided on pages 6–8, and also in Example 1 (page 11, at [0034]), and in figures 3A through 3E.

## **VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL**

1. Whether claims 1, 3, 4, 6 and 7 are unpatentable under 35 U.S.C. 103(a) over Porter et al. (U.S. Pat. Pub. No. 2005/0089901) in view of Jacobson et al. (U.S. Pat. No. 6,323,989).

2. Whether claims 2, 5, 8 and 9 are unpatentable under 35 U.S.C. §103(a) over Porter et al. (U.S. Pat. Pub. No. 2005/0089901) in view of Jacobson et al. (U.S. Pat. No. 6,323,989), further in view of Cao et al. (Nanoparticles with Raman Spectroscopic Fingerprints for DNA and RNA Detection, *Science* **297**: 1536–40 (2002)).

## **VII. ARGUMENT**

Briefly, Appellants' invention is to biosensors, systems and methods for detecting biomolecules using surface-enhanced Raman spectroscopy (SERS). Prior to Appellant's invention, the SERS had been used for the analyses of numerous chemicals and biochemicals, but the techniques failed to provide quantitative measurements with reproducible results. Appellants recognized for the first time that reproducible and quantitative/qualitative detection of a target biomolecule is possible, by employing detector nanoparticles associated with the target biomolecule.

1. **Claims 1, 3, 4, 6 and 7 stand rejected under 35 U.S.C. 103(a) over Porter et al. (U.S. Pat. Pub. No. 2005/0089901) in view of Jacobson et al. (U.S. Pat. No. 6,323,989).**

"The initial burden of establishing a basis for denying patentability to a claimed invention rests upon the Examiner. In establishing a *prima facie* case of obviousness under 35 U.S.C. §103, it is incumbent upon the examiner to provide a reason *why* one of ordinary skill in the art would have been led to modify a prior art reference or to combine reference teachings to arrive at the claimed invention." *Ex Parte Nesbit*, 25 USPQ2d 1817,1818-9 (BPAI 1992) (*internal citations omitted*). The requisite motivation must stem from –not the applicant's disclosure—but from some teaching, suggestion or inference in the prior art. *Id.*

The ultimate determination of patentability is based on the entire record, by a preponderance of evidence, with due consideration to the persuasiveness of any arguments and any secondary evidence. *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992). Sufficient findings of fact must be made in order to merit deference under the “substantial evidence” standard by the Administrative Procedure Act (APA). *In re Gartside*, 203 F.3d 1305, 1315 (Fed. Cir. 2000).

The Office argues that the claims are obvious in view of Porter (disclosing methods for using a single nanoparticle as a surface enhancing particle) in view of Jacobson (disclosing methods for manipulating charged particles electrostatically). The Office argues that the disclosures of the cited references could somehow be combined to provide the claimed methods of determining the presence of a biomolecule using SERS and electrochemistry.

A. The references do not teach or suggest all the claim limitations.

The prior art reference (or references when combined) must teach or suggest all the claim limitations. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). A required limitation of each currently pending claim is "forming a first detector complex electrochemically."

Electrochemistry refers to chemical reactions driven by electrical energy. Chemical reactions include a change in the arrangement of atoms or molecules to yield substances of different composition and properties. Porter is directed to methods using a single nanoparticle as a surface-enhancing particle, but does not teach or suggest using a detector complex formed electrochemically on a substrate surface. Indeed, the most recent Office Action admits that Porter does not teach this required element of the claims.

The Jacobson reference, which the Office Action cites to remedy the shortcomings of Porter, does not disclose electrochemistry. Rather, Jacobson discloses manipulating charged nanoparticles electrostatically (*see* col. 10–11). In the presence of an electric field, a charged nanoparticle is attracted to or repelled from another charged particle or moiety. This is an electrostatic interaction, which Jacobson uses in an electrophoretic display. Electrostatics and electrophoresis are distinct from electrochemical processes. Electrostatics and electrophoresis refer to the movement of charged particles in a field. Electrochemistry refers to chemical reactions driven by electrical energy. Moving charged particles in an electrical field is distinctly different than the electrochemical processes used in the presently claimed invention.

Accordingly, the Porter reference, either alone or in combination with the Jacobson reference, fails to teach or suggest forming a detector complex electrochemically on a conductive substrate, a required element of all of the present claims.

B. The Porter reference has additional shortcomings not remedied by Jacobson.

The most recent Office Action asserts that the Porter reference discloses methods for detecting a biomolecule employing two nanoparticles. However, the Porter reference actually discloses methods using a single nanoparticle, referred to as a "surface enhancing particle."

The Office Action asserts that the "Raman-active reporter molecule" is a second nanoparticle. A molecule, however, is not a particle. The Porter reference calls out numerous candidate molecules for enhancing Raman signal, many of which are dye molecules. The



reporter molecule may also be a polymeric particle (*see* paragraphs 46–47). Nowhere does the Porter reference disclose or suggest that the polymeric particle could be a nanoparticle. Nor does the reference indicate whether the particle would be suitable for electrochemical reaction with a nanoparticle or anything else. In contrast, the presently claimed method provides that the detector complex is formed "electrochemically."

The specification of the present Application indicates that the nanoparticles used in the presently claimed methods are made from materials such as "semiconductive materials (e.g., silicon) and metals such as gold, silver, copper and platinum" and "metal nanoparticles and metal nanoparticle precursors." Such nanoparticles can undergo electrochemical interactions to form a detector complex. These shortcomings in Porter are not remedied by the Jacobson reference. The Jacobson reference discloses manipulating charged nanoparticles electrostatically, but does not teach or suggest forming a detector complex electrochemically on a conductive surface.

This is a required element of all the present claims and Applicants contend that the cited references neither teach nor suggest the presently claimed methods. The Office has not established *prima facie* obviousness, and Applicants therefore respectfully request the rejection to be reversed.

2. **Claims 2, 5, 8 and 9 stand rejected under 35 U.S.C. §103(a) over Porter et al. (U.S. Pat. Pub. No. 2005/0089901) in view of Jacobson et al. (U.S. Pat. No. 6,323,989), further in view of Cao et al. (Nanoparticles with Raman Spectroscopic Fingerprints for DNA and RNA Detection, Science 297: 1536–40 (2002)).**

As indicated above, a required element of each currently pending claim is "forming a first detector complex electrochemically." Porter is directed to methods using a single nanoparticle as a surface-enhancing particle, but does not teach or suggest using a detector complex formed electrochemically on a substrate surface. Indeed, the most recent Office Action admits that Porter does not teach this required element of the claims.

This deficiency in the Porter reference is not overcome by the Jacobson reference. This reference, which the Office Action cites to remedy the shortcomings of Porter, does not disclose electrochemistry. Rather, Jacobson discloses manipulating charged nanoparticles electrostatically. In the presence of an electric field, a charged nanoparticle is attracted to or

repelled from another charged particle or moiety, in what is essentially an electrophoretic process. This is easily distinguishable from the electrochemical processes required in the presently claimed methods. The detector complex is formed by applying an electrical potential to the conductive substrate, resulting in the electrochemical deposition of the detector nanoparticles on the target complex (to form the detector complex).

The most recent Office Action admits that the combination of Porter and Jacobson do not teach a detector nanoparticle being a silver nanoparticle, forming a target complex with the target biomolecule and target nanoparticle. Instead, the Office Action cites Cao et al., as teaching methods for forming a target complex with functionalized gold nanoparticles, and silver nanoparticles as detector nanoparticles. Applicants disagree with this contention. The Cao reference teaches a three-component sandwich assay for use with microarrays. Nanoparticles labeled with Raman active dyes are modified with functionalized oligonucleotides that can detect specific DNA sequences (i.e. the nanoparticles act as probes for a specific sequence). There is, however, no disclosure in Cao about forming such probes electrochemically on a conductive substrate. Claims 2, 5, 8 and 9 are dependent claims and incorporate all the limitations of claim 1. The formation of the detector complex electrochemically on a conductive substrate is a key limitation of the claims, but is not taught or suggested in the Cao reference.

As none of the cited references, either alone or in combination, teach or suggest all the claim limitations, the presently claimed invention is not obvious. Accordingly, for the reasons set forth herein and above, the Applicants respectfully request that this rejection be reversed.

### **SUMMARY**

In view of the above, it is respectfully submitted based on the present facts and applicable law that Appellant's invention as claimed is patentable.

It is earnestly requested that the Honorable Board reverse the Examiner's rejection, and that all of the pending claims be allowed.

Please charge any additional fees or credit overpayment to Deposit Account No. 50-1078.

Respectfully submitted,  
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Date: Sept 5, 2006

Mark T. Skoog  
By: Mark T. Skoog  
Reg. No. 40,178  
MTS:HLV:kf

## **VIII. CLAIMS APPENDIX**

1. A method for determining the presence of biomolecules using a surface-enhanced Raman spectroscopy (SERS) system, comprising:
  - providing a first target biomolecule, a first target nanoparticle, and a first detector nanoparticle;
  - forming a first detector complex electrochemically on a conductive substrate, wherein the first detector complex includes the first target biomolecule, the first target nanoparticle, and the first detector nanoparticle, wherein the first detector nanoparticle is disposed on the first target nanoparticle, wherein the first target nanoparticle is disposed on the first target biomolecule, and wherein the first target biomolecule is disposed on the conductive substrate;
  - directing a laser at the first detector complex, wherein the interaction of the laser with the first detector complex produces a SERS signal specific for the first target biomolecule; and
  - detecting the SERS signal, wherein the presence of the SERS signal indicates the presence of the biomolecule.
2. The method of claim 1, wherein forming the first detector complex electrochemically, further comprises:
  - forming a first target complex that includes the first target biomolecule and the first target nanoparticle; and
  - disposing the first target complex onto the first conductive substrate.
3. The method of claim 1, wherein forming the first detector complex electrochemically, further comprises:
  - disposing the first target biomolecule onto the first conductive substrate;
  - contacting the first target nanoparticle with the first target biomolecule; and
  - forming a first target complex on the first conductive substrate, wherein the first target complex includes the first target biomolecule and the first target nanoparticle.

4. The method of claim 1, wherein the first target nanoparticle includes a gold nanoparticle.
5. The method of claim 1, wherein the first detector nanoparticle includes a silver nanoparticle.
6. The method of claim 1, wherein forming a first detector complex, comprises:  
applying a voltage to the first conductive support.
7. The method of claim 1, wherein forming a first detector complex comprises:  
contacting the first conductive substrate to a foreign conductive structure to cause the reduction of the first detector nanoparticle onto the first target nanoparticle.
8. The method of claim 1, wherein a first marker molecule is attached to the first target biomolecule.
9. The method of claim 1, wherein a first marker molecule is attached to the first target nanoparticle.

## **IX. EVIDENCE APPENDIX**

### **OFFICE ACTIONS AND AMENDMENTS/RESPONSES**

- A. March 9, 2005: Non-final Office Action
- B. September 9, 2005: Amendment and Response to Non-Final Office Action
- C. December 2, 2005: Final Office Action
- D. February 9, 2006: Amendment and Response after Final
- E. March 7, 2006: Advisory Action
- F. April 3, 2006: Notice of Appeal

### **REFERENCES RELIED UPON BY THE EXAMINER**

- G. Porter et al., U.S. Pat. Pub. No. 2005/0089901
- H. Jacobson et al., U.S. Pat. No. 6,323,989
- I. Cao et al. (Nanoparticles with Raman Spectroscopic Fingerprints for DNA and RNA Detection, *Science*: 1536–40 (2002))

### **REFERENCES CITED IN THE BRIEF**

- J. *Ex Parte Nesbit*, 25 USPQ2d 1817,1818-9 (BPAI 1992)
- K. *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992)
- L. *In re Gartside*, 203 F.3d 1305, (Fed. Cir. 2000)
- M. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974)

**X. RELATED PROCEEDINGS APPENDIX**

None.



## UNITED STATES PATENT AND TRADEMARK OFFICE

MAR 14 2005

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United States Patent and Trademark Office  
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/824,548	04/14/2004	Daniel B. Roitman	10030531-1	6420

7590

03/09/2005

AGILENT TECHNOLOGIES, INC.

Legal Department, DL429

Intellectual Property Administration

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EXAMINER

YU, MELANIE J

ART UNIT

PAPER NUMBER

1641

DATE MAILED: 03/09/2005

6-9-05  
US ACTION \_\_\_\_\_  
SUE DATE \_\_\_\_\_  
Paper Dated \_\_\_\_\_  
OA ☒ FINAL \_\_\_\_\_  
Msg Pt \_\_\_\_\_ Charge \_\_\_\_\_  
Appeal \_\_\_\_\_ Issue Fee \_\_\_\_\_  
Other \_\_\_\_\_

Please find below and/or attached an Office communication concerning this application or proceeding.

THZ



**Office Action Summary**

Application No.

10/824,548

Applicant(s)

ROITMAN ET AL.

Examiner

Melanie Yu

Art Unit

1641

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.135(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 16 February 2005.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-15 is/are pending in the application.
- 4a) Of the above claim(s) 10-15 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-9 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 14 April 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 4/14.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## **DETAILED ACTION**

### ***Election/Restrictions***

1. Applicant's election with traverse of group I, claims 1-9, in the reply filed on February 16, 2005 is acknowledged. The traversal is on the ground(s) that the restriction requirement is unfair to the Applicant because it will require Applicant to file and bear the additional cost and time delay associated with filing additional divisional applications. This is not found persuasive because Applicant is entitled to only one invention per patent and pursuing more than one invention would require examiner to dilute time and resources required for prosecution of the application. Applicant also argues that the examination of two or more inventions can be made without "serious burden". Though the methods of groups I and II contain overlapping subject matter, the search for the method of group I would not encompass a search for the method of group II. The method of group I requires searching for forming a first detector complex electrochemically on a conductive substrate, which is not required for the search of group II. Examination of the method of group II requires a search for catalyzing the deposition of first target nanoparticles on the first target complex, which is not required for the search of group I. The inventions of groups I and II required different searches and are therefore patentably distinct.

The requirement is still deemed proper and is therefore made FINAL.

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

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2. Claims 2 and 3 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claims 2 and 3 recite forming a first detector complex electrochemically in the preamble of the claims. Claim 1 recites the inclusion of a first target biomolecule, a first target nanoparticle and a first detector nanoparticle in the first detector complex. However, in the body of claims 2 and 3, there is no mention of a first detector nanoparticle and how it is formed with the first target biomolecule and the first target nanoparticle on the conductive substrate. Therefore, claims 2 and 3, lack essential steps, and it is unclear whether the electrochemical formation of a first detector complex is intended to include a first detector nanoparticle.

*Claim Rejections - 35 USC § 102*

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1-9 are rejected under 35 U.S.C. 102(b) as being anticipated by Natan (US 6,025,202).

Natan teaches a method comprising: providing a first target biomolecule, a first target nanoparticle, and a first detector nanoparticle (target biomolecule is the biotin/streptavidin complex, first target nanoparticle is the Au nanoparticle, col. 3, lines 3-21; first detector nanoparticle is disclosed in an alternate embodiment where Au nanoparticles are coated with Ag nanoparticles in order to reduce interparticle spacing, col. 9, line 63-col. 10, line 2); forming a

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first detector complex electrochemically on a conductive substrate (col. 21, lines 9-14), wherein the first detector complex includes the first target biomolecule, the first target nanoparticle, and the first detector nanoparticle (col. 3, lines 3-21; col. 9, line 63-col. 10, line 2), wherein the first detector nanoparticle is disposed on the first target nanoparticle (deposition of Ag particle on Au particle, col. 9, line 63-col. 10, line 2), wherein the first target nanoparticle is disposed on the conductive substrate (conductive substrates; col. 9, lines 25-37); directing a laser at the first detector complex, wherein the interaction of the laser with the first detector complex produces a SERS signal specific for the first target biomolecule (col. 17, lines 64-67; col. 18, lines 11-13; col. 21, lines 29-36); and detecting the SERS signal (col. 18, lines 13-16; col. 21, lines 29-36).

With respect to claims 2, 3, 6 and 7, Natan teaches forming a first detector complex electrochemically comprising: forming a first target complex that includes the first target biomolecule and the first target nanoparticle (first target biomolecule is the biotin/streptavidin complex and first target nanoparticle is the Au particle; col. 3, lines 3-21); and disposing the first target complex onto the first conductive substrate (the first target biomolecule and Au particle are disposed on a substrate of glass or metal, col. 3, lines 3-6, which is disclosed as conductive, col. 9, lines 25-27). Natan also teaches the method of forming a first detector complex comprising: disposing the first target biomolecule onto the first conductive substrate (biotin disposed on substrate, col. 3, lines 3-6, which is disclosed as conductive, col. 9, lines 25-27); contacting the first target nanoparticle with the first target biomolecule (Au-streptavidin conjugate is exposed to biotinylated surface, col. 3, lines 19-21); and forming a first target complex on the first conductive substrate, wherein the first target complex includes the first target biomolecule and the first target nanoparticle (biotin binds to streptavidin, which binds the

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biomolecule to the Au particle, col. 3, lines 15-16). Natan further teaches applying a voltage to the first conductive support to form a first detector complex (col. 21, lines 14-16) and contacting the first conductive substrate to a foreign conductive substrate to cause reduction of the first detector nanoparticles onto the first target nanoparticle (electrodes applied to foreign Pt gauze electrode which are removed after electrochemical deposition, col. 21, lines 11-19).

Regarding claims 4 and 5, Natan teaches the first target nanoparticle including a gold nanoparticle (col. 3, lines 19-21) and the first detector nanoparticle including a silver nanoparticle (col. 9, lines 62-67; col. 21, lines 3-7).

With respect to claims 8 and 9, Natan teaches the method for determining the presence of biomolecules using a SERS system further comprising a first marker molecule attached to the first target nanoparticle (cytochemical marker attached to first target nanoparticle, Au; col. 12, line 66-col. 13, line 2) or the first target biomolecule (cytochemical marker is indirectly attached to first target nanoparticle which is attached to first target biomolecule; col. 12, line 66-col. 13, line 2).

### *Conclusion*

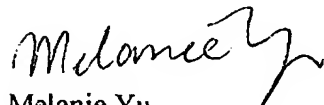
4. No claims are allowed.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Melanie Yu whose telephone number is (571) 272-2933. The examiner can normally be reached on M-F 8:30-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Long Le can be reached on (571) 272-0823. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Art Unit: 1641

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Melanie Yu  
Patent Examiner  
Art Unit 1641



LONG V. LE  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 1600

03/04/05

<b>FORM PTO-1449</b>  <b>LIST OF PATENTS AND PUBLICATIONS FOR APPLICANT'S INFORMATION DISCLOSURE STATEMENT</b>  (Use several sheets if necessary)	<b>ATTY. DOCKET NO.</b> <b>10030531-1</b>	<b>SERIAL NO.</b>
	<b>APPLICANT</b> <b>Roitman et al.</b>	
	<b>FILING DATE</b> <b>04/14/2004</b>	<b>GROUP</b> <b>TBA</b>

**REFERENCE DESIGNATION**

**U.S. PATENT DOCUMENTS**

EXAMINER INITIAL	*	DOCUMENT NUMBER	DATE	NAME
my		6,361,944	03/26/2002	Mirkin et al.

**FOREIGN PATENT DOCUMENTS**

		DOCUMENT NUMBER	DATE	NAME	TRANSLATION	
					YES	NO

**OTHER REFERENCES (including Author, Title, Date, Pertinent Pages, etc.)**


<b>EXAMINER</b> <i>Melanie</i>	<b>DATE CONSIDERED</b> <i>2/28/05</i>
-----------------------------------	--

\* Copies of these references are not enclosed pursuant to 37 CFR 1.98(d). (See accompanying IDS)

**Notice of References Cited**

Application/Control No.

10/824,548

Applicant(s)/Patent Under  
Reexamination  
ROITMAN ET AL.

Examiner

Melanie Yu

Art Unit

1641

Page 1 of 1

**U.S. PATENT DOCUMENTS**

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-6,025,202	02-2000	Natan, Michael J.	436/104
	B	US-2003/0059820	03-2003	Vo-Dinh, Tuan	435/6
	C	US-5,567,628	10-1996	Tarcha et al.	436/525
	D	US-6,579,721	06-2003	Natan et al.	436/164
	E	US-6,149,868	11-2000	Natan et al.	422/82.05
	F	US-6,242,264	06-2001	Natan et al.	436/171
	G	US-2004/0023261	02-2004	Bruchez et al.	435/6
	H	US-2003/0211488	11-2003	Mirkin et al.	435/6
	I	US-2003/0099940	05-2003	Empedocles et al.	435/6
	J	US-6,776,962	08-2004	Boss et al.	422/82.11
	K	US-			
	L	US-			
	M	US-			

**FOREIGN PATENT DOCUMENTS**

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

**NON-PATENT DOCUMENTS**

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

\*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)  
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.



S/N 10/824,548

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	ROITMAN ET AL.	Examiner:	M. YU
Serial No.:	10/824,548	Group Art Unit:	1641
Filed:	APRIL 14, 2004	Docket No.:	10030531-01
Confirmation No.:	6420	Customer No.:	22878
Title:	SURFACE-ENHANCED RAMAN SPECTROSCOPY FOR BIOSENSOR SYSTEMS AND METHODS FOR DETERMINING THE PRESENCE OF BIOMOLECULES		

CERTIFICATE UNDER 37 CFR 1.8:

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail, with sufficient postage, in an envelope addressed to: Mail Stop AMENDMENT, Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 on September 9, 2005.

By:

Name: Sheryl A. Boerboom

AMENDMENT AND RESPONSE

Commissioner for Patents  
Washington, D.C. 20231

Dear Sir:

In response to the Office Action of March 9, 2005, please amend the above-identified application as follows:

**Amendments to the Claims** are reflected in the listing of claims that begins on page 2 of this paper.

**Remarks** begin on page 5 of this paper.

This listing of claims will replace all prior versions and listings of claims in the application:

**Listing of Claims:**

1. (Currently Amended) A method for determining the presence of biomolecules using a surface-enhanced Raman spectroscopy (SERS) system, comprising:
  - providing a first target biomolecule, a first target nanoparticle, and a first detector nanoparticle;
  - forming a first detector complex electrochemically on a conductive substrate, wherein the first detector complex includes the first target biomolecule, the first target nanoparticle, and the first detector nanoparticle, wherein the first detector nanoparticle is disposed on the first target nanoparticle, wherein the first target nanoparticle is disposed on the first target biomolecule, and wherein the first target biomolecule is disposed on the conductive substrate;
  - directing a laser at the first detector complex, wherein the interaction of the laser with the first detector complex produces a SERS signal specific for the first target biomolecule; and
  - detecting the SERS signal, wherein the presence of the SERS signal indicates the presence of the biomolecule.
2. (Currently Amended) The method of claim 1, wherein forming a the first detector complex electrochemically, further comprises:
  - forming a first target complex that includes the first target biomolecule and the first target nanoparticle; and
  - disposing the first target complex onto the first conductive substrate.
3. (Currently Amended) The method of claim 1, wherein forming a the first detector complex electrochemically, further comprises:
  - disposing the first target biomolecule onto the first conductive substrate;
  - contacting the first target nanoparticle with the first target biomolecule; and

forming a first target complex on the first conductive substrate, wherein the first target complex includes the first target biomolecule and the first target nanoparticle.

4. (Original) The method of claim 1, wherein the first target nanoparticle includes a gold nanoparticle.
5. (Original) The method of claim 1, wherein the first detector nanoparticle includes a silver nanoparticle.
6. (Original) The method of claim 1, wherein forming a first detector complex, comprises:  
applying a voltage to the first conductive support.
7. (Original) The method of claim 1, wherein forming a first detector complex comprises:  
contacting the first conductive substrate to a foreign conductive structure to cause the reduction of the first detector nanoparticle onto the first target nanoparticle.
8. (Original) The method of claim 1, wherein a first marker molecule is attached to the first target biomolecule.
9. (Original) The method of claim 1, wherein a first marker molecule is attached to the first target nanoparticle.

10-25. (Canceled)

### **REMARKS**

Applicants have received and reviewed an Office Action dated March 9, 2005. By way of response, Applicants have canceled claims 10-25 without prejudice and amended claims 1, 2 and 3. No new matter is presented. Claims 1-9 are pending. Applicants submit that the pending claims are supported by the specification.

For the reasons given below, Applicants submit that the amended claims are in condition for allowance and notification to that effect is earnestly solicited.

#### **Rejection of Claims Under § 112, Second Paragraph**

The Examiner rejected claims 2 and 3 under 35 U.S.C. § 112, second paragraph. The Office Action asserts that claims 2 and 3 should include additional steps. Applicants respectfully traverse this rejection.

First, Applicants respectfully submit that a dependent claim includes all of the features of the independent claim plus those features recited in the dependent claim. Therefore, claims 2 and 3 as filed were complete and included all features of claim 1.

Nonetheless, solely to expedite prosecution of the application and not to acquiesce to the reasoning of the Office Action, Applicants have amended claims 2 and 3. The amended claims recite that forming "the" first detector complex "further" comprises the features stated in the dependent claim. The claims now more emphatically state that dependent claims include all of the features of independent claim 1. The claims were not narrowed by this amendment.

Accordingly, it is believed that the amended claims fully comply with § 112, second paragraph, and withdrawal of this rejection is respectfully requested.

#### **Rejection of Claims Under § 102(b)**

The Examiner rejected claims 1-9 under 35 U.S.C. § 102(b) as being anticipated by Natan (U.S. Patent No. 6,025,202). Applicants respectfully traverse this rejection.

The Office Action asserts that the Natan reference discloses methods for detecting a biomolecule. Applicants respectfully disagree. In fact, the Natan reference discloses methods for making a SERS-sensitive surface and for measuring the Raman spectrum of an unknown, such as a pesticide, stuck to the surface.

The Natan system including the metal colloid monolayer is made and used to detect analytes to which the monolayer has been exposed. The analyte is absorbed onto the monolayer and the Raman IR spectrum of the analyte determined by employing SERS (see, e.g., column 25, lines 24-48).

In contrast, the presently claimed method includes detecting the SERS signal, wherein the presence of the SERS signal indicates the presence of the biomolecule. This present method detects the biomolecule through the existence of the signal, not the spectrum obtained. Therefore, the Natan reference neither teaches nor suggests the presently claimed method.

Accordingly, based on the foregoing differences, it is submitted that the reference cited in the prior art rejection neither teaches nor suggests the presently claimed method, and withdrawal of this rejection is respectfully requested.

#### Summary

In summary, Applicants submit that each of claims 1-9 are in condition for allowance. The Examiner is invited to contact Applicant's undersigned representative at the telephone number listed below, if the Examiner believes that doing so will expedite prosecution of this application.

Respectfully submitted,

Merchant & Gould P.C.  
P.O. Box 2903  
Minneapolis, MN 55402-0903  
612/332-5300

Dated: Sept 9, 2005

By: Mark T. Skoog  
Mark T. Skoog  
Reg. No. 40,178  
MTS:sab



# UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/824,548	04/14/2004	Daniel B. Roisman	10030531-1	6420

7590 12/02/2005

AGILENT TECHNOLOGIES, INC.  
Legal Department, DL429  
Intellectual Property Administration  
P.O. Box 7599  
Levealand, CO 80537-0599

EXAMINER

YU, MELANIE J

ART UNIT	PAPER NUMBER
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1641

DATE MAILED: 12/02/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	Application No.	Applicant(s)	
	10/824,548	ROITMAN ET AL.	
	Examiner	Art Unit	
	Melanie Yu	1641	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION:

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 30 September 2005.
- 2a) ☒ This action is FINAL.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-9 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-9 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 14 April 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
     Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
     Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                        | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)               | Paper No(s)/Mail Date. _____  |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>9/30</u> .  | 6) <input type="checkbox"/> Other: _____                                    |

### DETAILED ACTION

1. Applicant's amendment filed 30 September 2005 has been entered. Claims 1-3 are currently amended. Claims 10-25 are cancelled. Claims 1-9 are currently pending in this application.

### *Withdrawn Rejections*

2. Rejection of claims under 35 USC 112, second paragraph have been withdrawn.

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

1. Claims 1, 3, 4, 6 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Porter et al. (US 2005/0089901, priority Sep. 22, 2005) in view of Jacobson et al. (US 6,323,989).

Porter et al. teach a method for determining the presence of biomolecules using a SERS system, comprising: providing a first target molecule, a first target nanoparticle,



Art Unit: 1641

and a first detector nanoparticle (gold particles are target nanoparticles, par. 18; Raman active reporter molecule is a detector nanoparticle, par. 46; target analyte is target molecule, par 50; par. 15-16); forming a first detector complex on a conductive substrate (Raman-active reagents can be metal complexes and are immobilized to analytes on a substrate, par. 69; gold substrate, Fig. 6, is conductive, par. 83), wherein the first detector complex includes the first target biomolecule, the first target nanoparticle and the first detector nanoparticle, wherein the first detector nanoparticle is disposed on the conductive substrate (detector nanoparticle is a Raman active reporter molecule and is disposed on a target nanoparticle on a surface enhancing particle with a binding molecule and binding molecule binds to the analyte which is the target biomolecule, par. 15-16); directing a laser at the first detector complex, wherein the interaction of the laser with the first detector complex produces a SERS signal specific for the first target biomolecule (par. 67); and detecting the SERS signal, wherein the presence of the SERS signal indicates the presence of the biomolecule (intensity of Raman scattering signal detected, par. 63). However, Porter et al. fail to teach the first detector complex formed on a conductive substrate electrochemically.

Jacobson et al. teach applying a voltage to a conductive substrate (col. 14, line 53-col. 14, line 14) wherein the application of voltage forms an aggregation of tethered (col. 10, lines 59-col. 11, line 4) gold nanoparticles (col. 15, lines 9-12) or silver nanoparticles (col. 7, lines 4-13), wherein two different types of nanoparticles may be present (Fig. 3A, col. 14, lines 53-67), in order to produce a detectable signal by aggregating gold nanoparticles.

Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to include in the formation of a complex of Porter et al., provide a first and second electrode and applying a voltage to a substrate in order to form an aggregation of tethered gold and silver nanoparticles at the electrode surface as taught by Jacobson et al., in order to provide movement of nanoparticles toward the electrode surface thus providing faster and more efficient binding to the analyte on the substrate which would efficiently form detector complexes. It would have also been obvious to use this method in order to control the movement of nanoparticles as described in par. 71 of Porter et al. when the particles gold nanoparticles instead of magnetic nanoparticles. Although Jacobson et al. do not specify electrochemical formation, the voltage of Jacobson et al. is applied in order to aggregate nanoparticles which would form the complexes of Porter et al., which is the same electrochemical method taught in the instant specification.

Regarding claim 7, Jacobson et al. teach contacting the first conductive substrate to a foreign conductive structure (304 and 306, Fig. 3A-3C), which would cause reduction of the first detector nanoparticle of Porter et al. onto the first target nanoparticle of Porter et al. by aggregating the nanoparticles and then becoming tethered.

Claims 2, 5, 8 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Porter et al. (US 2005/0089901, priority Sep. 22, 2005) in view of Jacobson et al. (US 6,323,989) further in view of Cao et al. (Nanoparticles with Raman Spectroscopic Fingerprints for DNA and RNA detection, Science, Aug 2002, pgs. 1536-1540).

Porter et al. in view of Jacobson et al. teach a method for determining the presence of biomolecules comprising a gold target nanoparticle and a metal complex as a detector nanoparticle (par. 46), but fail to teach the first detector nanoparticle specifically being a silver nanoparticle and a forming a first target complex that includes the first target biomolecule and the first target nanoparticle; and disposing the first target complex onto the first conductive substrate.

Cao et al. teach forming a target complex comprising a first target biomolecule and a first target nanoparticle (gold nanoparticles are functionalized with oligonucleotides before disposing the first target complex on a substrate, pg. 1537, right column, first paragraph), and silver nanoparticles being detector nanoparticles wherein gold nanoparticles are a first target complex (pg. 1537, second and third column), in order to produce a detectable Raman scattering signal.

Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to include in the method of Porter et al. in view of Jacobson et al., silver enhancing nanoparticle probes as a metal complex in order to produce an enhanced SERS signal.

Regarding claims 8 and 9, Cao et al. teach a first marker molecule attached to the first target nanoparticle (Cy3, pg. 1537, first column, second paragraph), and since the first target nanoparticle is attached to the biomolecule, the first marker molecule is also attached to the first target nanoparticle.

### ***Response to Arguments***

Art Unit: 1641

2. Applicant's arguments with respect to claims 1-9 have been considered but are moot in view of the new ground(s) of rejection. Upon further consideration, the new ground(s) of rejection is made in view of applicant's amendment requiring the new limitation of the presence of the SERS signal indicating the presence of the biomolecule.

### ***Conclusion***

No claims are allowed.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Melanie J. Yu whose telephone number is (571) 272-2933. The examiner can normally be reached on 8am-4:30pm Monday-Friday.

Art Unit: 1641

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Long Le can be reached on (571) 272-0823. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Melanie Yu  
Patent Examiner  
Art Unit 1641



LONG V. LE  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 1600

11/26/05

**RESPONSE UNDER 37 C.F.R. 1.116  
EXPEDITED PROCEDURE  
EXAMINING GROUP 1641**

S/N 10/824,548

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	ROITMAN ET AL.	Examiner:	M. YU
Serial No.:	10/824,548	Group Art Unit:	1641
Filed:	APRIL 14, 2004	Docket No.:	10030531-01
Confirmation No.:	6420	Customer No.:	22878
Title:	SURFACE-ENHANCED RAMAN SPECTROSCOPY FOR BIOSENSOR SYSTEMS AND METHODS FOR DETERMINING THE PRESENCE OF BIOMOLECULES		

CERTIFICATE UNDER 37 CFR 1.6(d):

I hereby certify that this paper is being transmitted by facsimile to the U.S. Patent and Trademark Office on

2-9-06.

By: Kay Fahland

Name: Kay Fahland

**RESPONSE**

Mail Stop AF  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, Virginia 22313-1450

Dear Sir:

In response to the Office Action of December 2, 2005, please amend the above-identified application as follows:

**Remarks** begin on page 2 of this paper.

### **REMARKS**

Applicants have received and reviewed an Office Action dated December 2, 2005. By way of response, Applicants present the following remarks. No new matter is presented. Claims 1-9 are pending. Applicants submit that the pending claims are supported by the specification.

For the reasons given below, Applicants submit that the claims are in condition for allowance and notification to that effect is earnestly solicited.

#### **Rejection of Claims Under § 103(a)**

The Examiner rejected claims 1, 3, 4, 6, and 7 under 35 U.S.C. § 103(a) as being obvious over Porter et al. (US 2005/0089901) in view of Jacobson et al. (U.S. 6,323,989). The Examiner rejected claims 2, 5, 8, and 9 under 35 U.S.C. § 103(a) as being obvious over Porter et al. (US 2005/0089901) in view of Jacobson et al. (U.S. 6,323,989) and further in view of the Cao et al. reference. Applicants respectfully traverse these rejections.

#### **Porter et al. In View of Jacobson et al. Neither Teaches Nor Suggests the Presently Claimed Invention**

The presently claimed invention includes "forming a first detector complex electrochemically". Electrochemistry refers to chemical reactions driven by electrical energy. Chemical reactions include a change in the arrangement of atoms or molecules to yield substances of different composition and properties.

The Office Action admits that the primary Porter et al. reference fails to teach or suggest the presently claimed invention employing a detector complex formed on a conductive substrate electrochemically. The Office Action employs the secondary Jacobson et al. reference to remedy this shortcoming of the primary reference.

The Jacobson et al. reference, however, does not disclose electrochemistry. The Jacobson et al. reference discloses manipulating charged nanoparticles electrostatically (columns 10 and 11). In the presence of an electric field, a charged nanoparticle is attracted to or repelled from another charged moiety, according to the Jacobson et al. reference. This is an electrostatic interaction, which Jacobson et al. employ in an electrophoretic display (electrophoresis refers to movement of charges in a field).

Electrostatics and electrophoresis are distinct from the presently claimed electrochemical process. Electrostatics and electrophoresis refer to movement of charged

particles in a field. Electrochemistry refers to chemical reactions driven by electrical energy. Moving charged particles in a field is distinctly different from the presently claimed chemical reactions driven by electrical energy.

Thus, the presently claimed methods including forming a detector complex electrochemically are neither taught nor suggested by disclosure of electrostatics moving charged particles.

The Office Action admits that the Porter et al. reference does not disclose or suggest the presently claimed invention. The Jacobson et al. reference does not remedy the shortcomings of the Porter et al. reference. Accordingly, this combination of references neither teaches nor suggests the presently claimed invention, and withdrawal of this rejection is respectfully requested.

#### Additional Shortcomings of the Porter et al. Reference

The Office Action asserts that the Porter et al. reference discloses methods for detecting a biomolecule employing two nanoparticles. Applicants respectfully disagree. The Porter et al. reference discloses a method employing a single nanoparticle referred to as a "surface enhancing particle".

The Office Action asserts that the Porter et al. "Raman-active reporter molecule" is a second nanoparticle. Applicants respectfully disagree. A molecule is not a nanoparticle. Paragraphs 46 and 47 of the Porter et al. application list numerous molecules that enhance a Raman signal. Many of the listed molecules are dyes. The very end of paragraph 46 indicates that the reporter molecule can be a "polymeric particle".

Nowhere does the Porter et al. reference disclose or suggest that this polymeric particle might be a nanoparticle or that it might be suitable for an electrochemical reaction with a nanoparticle or anything else. In contrast, the presently claimed method provides that the detector complex is formed "electrochemically".

Further, at page 10, paragraphs 29-31, the present specification indicates that the present invention employs nanoparticles made from materials such as "semiconductive materials (e.g., silicon) and metals such as gold, silver, nickel, copper and platinum" and "metal nanoparticles and metal nanoparticle precursors." Such nanoparticles can undergo electrochemical interactions to form a first detector complex.



Accordingly, based on the foregoing differences, it is submitted that the references cited in the prior art rejection neither teach nor suggest the presently claimed method, and withdrawal of this rejection is respectfully requested.

**Summary**

In summary, Applicants submit that each of claims 1-9 are in condition for allowance. The Examiner is invited to contact Applicant's undersigned representative at the telephone number listed below, if the Examiner believes that doing so will expedite prosecution of this application.

Respectfully submitted,

Merchant & Gould P.C.  
P.O. Box 2903  
Minneapolis, MN 55402-0903  
612/332-5300

Dated: Feb 9, 2006

By: Mark T. Skoog  
Mark T. Skoog  
Reg. No. 40,178



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/824,548	04/14/2004	Daniel B. Roitman	10030531-1	6420

7590 03/07/2006

AGILENT TECHNOLOGIES, INC.  
Legal Department, DL429  
Intellectual Property Administration  
P.O. Box 7599  
Levelland, CO 80537-0599

EXAMINER

YU, MELANIE J

ART UNIT

PAPER NUMBER

1641

DATE MAILED: 03/07/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

**Advisory Action  
Before the Filing of an Appeal Brief**

Application No.

10/824,548

Applicant(s)

ROITMAN ET AL.

Examiner

Melanie Yu

Art Unit

1641

**--The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

THE REPLY FILED 09 February 2006 FAILS TO PLACE THIS APPLICATION IN CONDITION FOR ALLOWANCE.

1. ☒ The reply was filed after a final rejection, but prior to or on the same day as filing a Notice of Appeal. To avoid abandonment of this application, applicant must timely file one of the following replies: (1) an amendment, affidavit, or other evidence, which places the application in condition for allowance; (2) a Notice of Appeal (with appeal fee) in compliance with 37 CFR 41.31; or (3) a Request for Continued Examination (RCE) in compliance with 37 CFR 1.114. The reply must be filed within one of the following time periods:

- a) ☒ The period for reply expires 3 months from the mailing date of the final rejection.  
b) ☐ The period for reply expires on: (1) the mailing date of this Advisory Action, or (2) the date set forth in the final rejection, whichever is later. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of the final rejection.  
Examiner Note: If box 1 is checked, check either box (a) or (b). ONLY CHECK BOX (b) WHEN THE FIRST REPLY WAS FILED WITHIN TWO MONTHS OF THE FINAL REJECTION. See MPEP 706.07(f).

Extensions of time may be obtained under 37 CFR 1.136(a). The date on which the petition under 37 CFR 1.136(a) and the appropriate extension fee have been filed is the date for purposes of determining the period of extension and the corresponding amount of the fee. The appropriate extension fee under 37 CFR 1.17(a) is calculated from: (1) the expiration date of the shortened statutory period for reply originally set in the final Office action; or (2) as set forth in (b) above, if checked. Any reply received by the Office later than three months after the mailing date of the final rejection, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**NOTICE OF APPEAL**

2. ☐ The Notice of Appeal was filed on \_\_\_\_\_. A brief in compliance with 37 CFR 41.37 must be filed within two months of the date of filing the Notice of Appeal (37 CFR 41.37(a)), or any extension thereof (37 CFR 41.37(e)), to avoid dismissal of the appeal. Since a Notice of Appeal has been filed, any reply must be filed within the time period set forth in 37 CFR 41.37(a).

**AMENDMENTS**

3. ☐ The proposed amendment(s) filed after a final rejection, but prior to the date of filing a brief, will not be entered because  
(a) ☐ They raise new issues that would require further consideration and/or search (see NOTE below);  
(b) ☐ They raise the issue of new matter (see NOTE below);  
(c) ☐ They are not deemed to place the application in better form for appeal by materially reducing or simplifying the issues for appeal; and/or  
(d) ☐ They present additional claims without canceling a corresponding number of finally rejected claims.

NOTE: \_\_\_\_\_. (See 37 CFR 1.116 and 41.33(a)).


4. ☐ The amendments are not in compliance with 37 CFR 1.121. See attached Notice of Non-Compliant Amendment (PTOL-324).  
5. ☐ Applicant's reply has overcome the following rejection(s): \_\_\_\_\_.  
6. ☐ Newly proposed or amended claim(s) \_\_\_\_\_ would be allowable if submitted in a separate, timely filed amendment canceling the non-allowable claim(s).  
7. ☐ For purposes of appeal, the proposed amendment(s): a) ☐ will not be entered, or b) ☐ will be entered and an explanation of how the new or amended claims would be rejected is provided below or appended.  
The status of the claim(s) is (or will be) as follows:  
Claim(s) allowed: \_\_\_\_\_.  
Claim(s) objected to: \_\_\_\_\_.  
Claim(s) rejected: \_\_\_\_\_.  
Claim(s) withdrawn from consideration: \_\_\_\_\_.

**AFFIDAVIT OR OTHER EVIDENCE**

8. ☐ The affidavit or other evidence filed after a final action, but before or on the date of filing a Notice of Appeal will not be entered because applicant failed to provide a showing of good and sufficient reasons why the affidavit or other evidence is necessary and was not earlier presented. See 37 CFR 1.116(e).  
9. ☐ The affidavit or other evidence filed after the date of filing a Notice of Appeal, but prior to the date of filing a brief, will not be entered because the affidavit or other evidence failed to overcome all rejections under appeal and/or appellant fails to provide a showing of good and sufficient reasons why it is necessary and was not earlier presented. See 37 CFR 41.33(d)(1).  
10. ☐ The affidavit or other evidence is entered. An explanation of the status of the claims after entry is below or attached.

**REQUEST FOR RECONSIDERATION/OTHER**

11. ☒ The request for reconsideration has been considered but does NOT place the application in condition for allowance because:  
See Continuation Sheet.  
12. ☐ Note the attached Information Disclosure Statement(s). (PTO/SB/08 or PTO-1449) Paper No(s). \_\_\_\_\_.  
13. ☐ Other: \_\_\_\_\_.

  
CHRISTOPHER L. CHIN  
PRIMARY EXAMINER  
GROUP 1800-1641

Continuation of 11. does NOT place the application in condition for allowance because: for the reasons stated in the previous office action dated 2 December 2005.

Applicant argues that Jacobson et al. fails to disclose electrochemistry and discloses manipulating charged nanoparticles electrostatically. Applicant argues that electrostatics and electrophoresis are distinct from the presently claimed electrochemical process. However, in response to applicant's arguments, although Jacobson et al. does not specify the deposition process as electrochemical, the deposition process of Jacobson et al. teach the same method as disclosed in the instant specification at page 8, paragraph 23, wherein the electrochemical deposition of the detector nanoparticles is provided by an electric potential applied to a conductive substrate and catalyzing the deposition of nanoparticles. Similarly, as described in the previous office action, Jacobson et al. teach applying a voltage to a conductive substrate wherein an application of voltage creates deposition of nanoparticles on a conductive substrate. Furthermore, the instant specification, describes the electrochemical deposition catalyzed by using galvanostatic forces, which are similar to the electrostatic forces used in Jacobson et al. Although Jacobson et al. fail to specify electrochemical deposition of nanoparticles, the deposition process is the same process that is defined as electrochemical by the instant specification. Therefore the deposition process of Jacobson et al. is electrochemical as defined by the instant specification.

Applicant also argues that the "Raman active reporter molecule" of Porter et al. is not a second nanoparticle because the majority of Raman-active reporter molecules listed by Porter et al. are dyes and the very end of paragraph 46 indicates that the reporter molecule can be a polymeric particle and would therefore be a second nanoparticle. Applicant further argues that Porter does not suggest that this particle might be suitable for an electrochemical reaction with a nanoparticle. However, claim 1 merely recites that the complex must be electrochemically formed on a conductive substrate and does not specifically recite that the complex must be formed electrochemically. Furthermore, Porter et al. is not relied upon for forming a complex electrochemically and Jacobson et al. is relied upon for this limitation.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Roitman et al.

Serial No.: 10/824,548

Examiner: M. Yu

Filing Date: April 14, 2004

Group Art Unit: 1641

Title: SURFACE-ENHANCED RAMAN SPECTROSCOPY FOR BIOSENSOR SYSTEMS AND METHODS  
FOR DETERMINING THE PRESENCE OF BIOMOLECULES

COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria VA 22313-1450

NOTICE OF APPEAL FROM THE EXAMINER TO THE  
BOARD OF PATENT APPEALS AND INTERFERENCES

Sir:

Applicant hereby appeals to the Board of Patent Appeals and Interferences from the decision of the examiner dated, , rejecting the following claims

The fee for this Notice of Appeal (37 CFR 1.17(b)) is \$500.00.

(complete (a) or (b) as applicable)

The proceedings herein are for a patent application and the provisions of 37 CFR 1.136(a) apply.

☒ (a) Applicant petitions for an extension of time under 37 CFR 1.136 (fees: 37 CFR 1.17(a)-(d) for the total number of months checked below:

<input checked="" type="checkbox"/>	one month	\$ 120.00
<input type="checkbox"/>	two months	\$ 450.00
<input type="checkbox"/>	three months	\$1020.00
<input type="checkbox"/>	four months	\$1590.00

☐ The extension fee has already been filled in this application.

☐ (b) Applicant believes that no extension of term is required. However, this conditional petition is being made to provide for the possibility that applicant has inadvertently overlooked the need for a petition and fee for extension of time.

Please charge to Deposit Account **50-1078** the sum of \$620.00. At any time during the pendency of this application, please charge any fees required or credit any overpayment to Deposit Account **50-1078** pursuant to 37 CFR 1.25.

A duplicate copy of this transmittal letter is enclosed.

☐ I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Date of Deposit: OR

☒ I hereby certify that this paper is being facsimile transmitted to the Patent and Trademark Office on the date shown below.

Date of Facsimile: April 3, 2006

Typed Name: Mark T. Skoog

Signature: Mark T. Skoog

Respectfully submitted,

Roitman et al.

By Mark T. Skoog

Attorney/Agent for Applicant(s)

Reg. No. 40,178

Date: April 3, 2006

Telephone No. 612-332-5300

## REPORTS

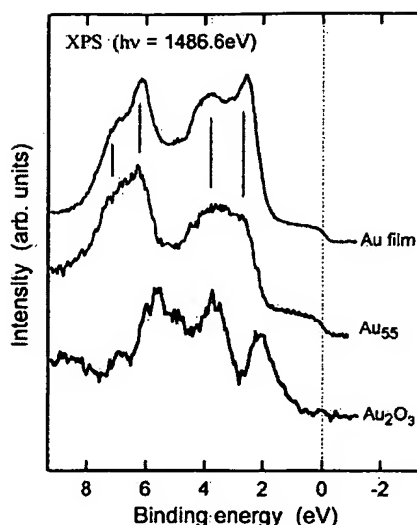


Fig. 4. XPS valence band spectra of naked  $\text{Au}_{55}$  clusters supported on silicon oxide, together with the corresponding spectra measured from an Au film and the  $\text{Au}_2\text{O}_3$  compound (6), respectively.

caused by size-induced modifications in the electronic structure. Rather, the closing of the second atomic shell is a more likely origin for the increased chemical stability. "Chemical selection," which avoids having an arbitrary number of atoms in a particle during the formation of phosphine-based Au clusters ( $\text{Au}_{13}$ ,  $\text{Au}_{55}$ ,  $\text{Au}_{147}$ , etc.), might itself result in oxidation resistance. On the other hand, the chemical stability of  $\text{Au}_{55}$  clusters might also be influenced by a high density of defects in the supporting material caused by the initial oxygen plasma treatment to remove the ligand shell. Defects in the support are known to modify the reactivity of Au clusters as compared to that of clusters on perfect substrates (7).

The observed stability against oxidation does not reflect a general property of ultrafine Au particles for particle diameters below a certain threshold. Rather, a nonmonotoneous size dependence was found with a pronounced minimum of reactivity for a cluster size of 1.4 nm. Interestingly enough, such a minimum of reactivity with atomic oxygen coincides with the existence of a pronounced maximum of catalytic efficiency for oxidation of CO to  $\text{CO}_2$  (8). Thus, we may speculate that  $\text{Au}_{55}$  clusters also exhibit unusual catalytic properties, such as in the oxidation of CO, because the catalyzing clusters will not be affected by the presence of atomic oxygen during the catalytic reaction.

### References and Notes

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12. All photoemission experiments were carried out in a FISON ESCALAB-210 electron spectrometer, allowing in situ preparation and analysis by means of monochromatized Al-K $\alpha$  radiation (photon energy  $h\nu = 1486.6$  eV).
13. G. Schmid *Inorg. Synth.* **7**, 214 (1990).
14. Although other small gold clusters (such as  $\text{Au}_{33}$ ) have been reported, only  $\text{Au}_{55}$  appears to be readily synthesized in sufficient yield for studies such as these.
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16. The thickness of the surface oxide can be estimated within an analysis using Doniach-Sunjić line shapes (20) to model the different contributions to the spectra (21) and applying standard formulas for angle-resolved photoemission (22). Taking estimated mean free path values for the Au-4f photoelectrons

of 2.0 and 3.1 nm (23) and known density values of  $19.3 \text{ g cm}^{-3}$  and  $11 \text{ g cm}^{-3}$  for the pure Au metal and the  $\text{Au}_2\text{O}_3$  compound, respectively, a thickness of 2.9 nm can be extracted for the oxide layer from Fig. 3A, in agreement with previous experiments on ex situ plasma-oxidized Au films (6).

17. The nanoparticle is divided into a large number of identical cells, each contributing to the photoelectron current an intensity that is affected by the attenuation in cells being closer to the surface according to the mean free path of the corresponding material within these cells (Au and  $\text{Au}_2\text{O}_3$ ).
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24. Financial support by the Bundesministerium für Bildung und Forschung, the Deutsche Forschungsgemeinschaft within SFB 569 and SPP 1072, the Swiss National Science Foundation, and the National Center of Competence in Research "Nanoscale Science" is gratefully acknowledged.

17 July 2002; accepted 25 July 2002

## Nanoparticles with Raman Spectroscopic Fingerprints for DNA and RNA Detection

YunWei Charles Cao, Rongchao Jin, Chad A. Mirkin\*

Multiplexed detection of oligonucleotide targets has been performed with gold nanoparticle probes labeled with oligonucleotides and Raman-active dyes. The gold nanoparticles facilitate the formation of a silver coating that acts as a surface-enhanced Raman scattering promoter for the dye-labeled particles that have been captured by target molecules and an underlying chip in microarray format. The strategy provides the high-sensitivity and high-selectivity attributes of gray-scale scanometric detection but adds multiplexing and ratioing capabilities because a very large number of probes can be designed based on the concept of using a Raman tag as a narrow-band spectroscopic fingerprint. Six dissimilar DNA targets with six Raman-labeled nanoparticle probes were distinguished, as well as two RNA targets with single nucleotide polymorphisms. The current unoptimized detection limit of this method is 20 femtomolar.

A highly sensitive and selective detection format for DNA relies on oligonucleotide-functionalized nanoparticles as probes, a particle-initiated Ag developing technique for signal enhancement, and a flatbed scanner for optical readout (1). The documented detection limit for this "scanometric DNA detection" format is 50 fM, (1) and the utility of the system has been demonstrated with short synthetic strands, polymerase chain reaction products, and genomic DNA targets (2, 3). However, a limitation of this approach is that

it is inherently a one-color system based on gray scale. The flexibility and applicability of all DNA-detection systems benefit from access to multiple types of labels with addressable and individually discernable labeling information. In the case of fluorescence, multiple fluorophores, including quantum dots, can be used to prepare encoded structures with optical signatures that depend on the types of fluorophores used and their signal ratio within the probes (4, 5). These approaches typically use micrometer-sized probes to obtain encoded structures with the appropriate signal intensities and uniformities. In the case of molecular fluorophores, overlapping spectral features and nonuniform fluorophore photobleaching rates lead to several potential complications (4, 6, 7).

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## REPORTS

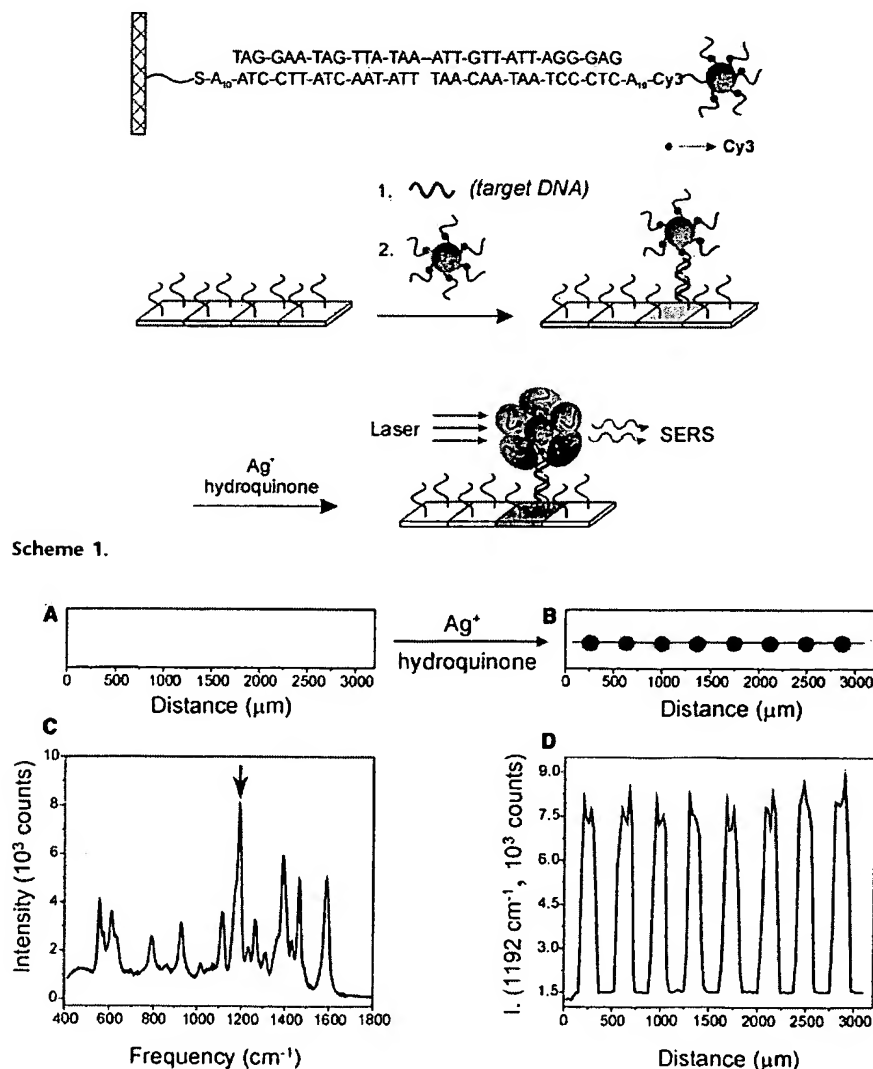
Here, we show that nanoparticles functionalized with oligonucleotides and Raman labels, coupled with surface-enhanced Raman scattering (SERS) spectroscopy, can be used to perform multiplexed detection of oligonucleotide targets (Scheme 1). Although oligonucleotides can be directly detected by SERS on aggregated particles (7, 8), the structural similarities of oligonucleotides with different sequences result in spectra that are difficult to distinguish. Therefore, researchers often use different Raman dyes to label different oligonucleotides to distinguish oligonucleotide sequences (9, 10). To realize the benefits of high-sensitivity and high-selectivity detection coupled with multiple labeling capabilities, we designed nanoparticle probes that can be used for DNA (or RNA) detection (Scheme 1). These probes consist of 13-nm-diameter Au particles functionalized with Raman dye-labeled oligonucleotides. The Raman spectroscopic fingerprint, which can be designed through choice of Raman label, can be identified after Ag enhancing by scanning Raman spectroscopy (Scheme 1). Because the SERS-active substrate in this strategy is generated immediately before the detection event, a large and reproducible Raman scattering response can be obtained.

In a typical experiment for DNA detection, a three-component sandwich assay is used in microarray format (Scheme 1). Au nanoparticles ( $13 \pm 2$  nm in diameter) modified with Cy3-labeled, alkylthiol-capped oligonucleotide strands were used as probes to monitor the presence of specific target DNA strands (11). On average, there are about 110 oligonucleotide strands on each 13-nm Au nanoparticle (12). The Cy3 group was chosen as a Raman label because of its large Raman cross section (13). A chip spotted with the appropriate 15-nucleotide capture strands was coated with a 0.6 M NaCl phosphate-buffered saline (PBS) buffer solution (10 mM of phosphate, pH 7) containing a 30-nucleotide target sequence (100 pM) in a humidity chamber at room temperature. After 4 hours, the chip was washed four times with 0.6 M NaCl PBS buffer solution to remove nonspecifically bound target. Then, the chip was treated with a 0.6 M NaCl PBS solution of nanoparticle probes (2 nM) for 1.5 hours to effect hybridization with the overhanging region of the target sequence (Scheme 1). The chip was then washed with 0.6 M NaNO<sub>3</sub> PBS buffer solution to remove chloride ions and nonspecifically bound nanoparticle probes. The chip was immediately treated with an Ag enhancement solution (Ted Pella, Inc., Redding, California) for 8 min, rinsed with Nanopure water, and dried with a microarray centrifuge (2000g). The chip, which exhibits gray spots visible to the naked eye, could be imaged with a flatbed scanner (Expression 1600, Epson America, Torrance, California) (Fig. 1B) (1–3). The spots also were studied by a Raman spectrometer coupled with a

fiber-optic probe with a 0.65-numerical aperture microscope objective (25- $\mu$ m laser beam) in a 0.3 M NaCl PBS buffer solution (Fig. 1C), and each of them shows a consistent and strong Raman response at 1192  $\text{cm}^{-1}$  (Fig. 1D) (Solution Raman 633 spectrometer from Concurrent Analytical, Inc., Waimanalo, Hawaii; 30 mW He-Ne laser).

Before Ag enhancing, the nanoparticle probes were invisible to the naked eye, and no Raman scattering signal was detectable (Fig. 1A). This is due to a lack of electromagnetic-field enhancement for the undeveloped nanoparticles (13 nm in diameter) in this state (7, 14, 15). Others have shown that closely spaced Au nanoparticles can give SERS enhancement (16, 17), but for DNA detection at technologically relevant target concentrations (<1 nM), nanopar-

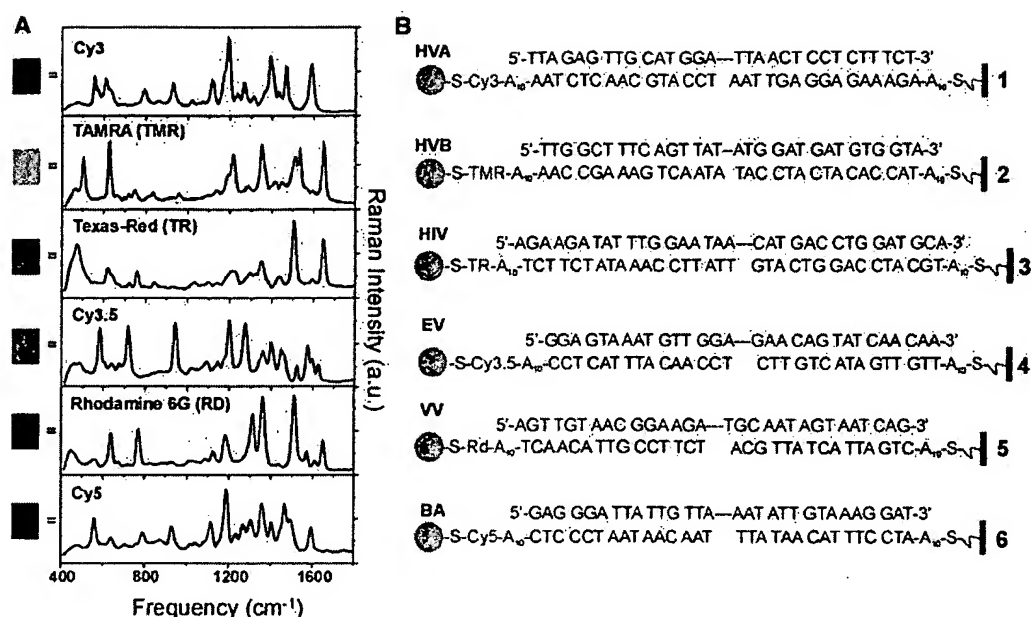
ticle spacings are too large to yield such effects. After Ag enhancing, the Ag particles can grow around the Cy3-labeled nanoparticle probes, leading to large Raman scattering enhancements. Typically, the spectra include both sharp Raman lines ( $\sim 15$  to 30  $\text{cm}^{-1}$  in spectral width) and a concomitant broad underlying continuum, as noted by Brus *et al.* in their studies of rhodamine 6G molecules on Ag particles (18). The Raman scattering signals arise almost exclusively from the Cy3 dye molecules immobilized on the particles; we do not observe signals from other species such as the oligonucleotides, solvent molecules, and the succinimidyl 4-(*p*-maleimidophenyl)butyrate on the glass surface. The Raman scattering frequency for each Raman line remains constant from experiment to



**Fig. 1.** Flatbed scanner images of microarrays hybridized with nanoparticles (A) before and (B) after Ag enhancing. (C) A typical Raman spectrum acquired from one of the Ag spots. (D) A profile of Raman intensity at 1192  $\text{cm}^{-1}$  as a function of position on the chip; the laser beam from the Raman instrument is moved over the chip from left to right as defined by the line in (B).

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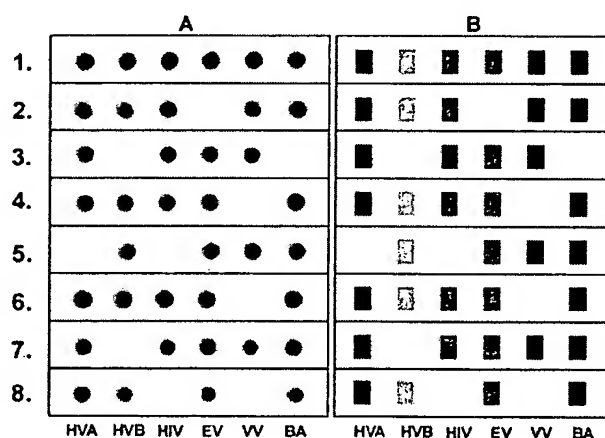
**Fig. 2. (A)** The Raman spectra of six dye-labeled nanoparticle probes after Ag enhancing on a chip (after background subtraction). Each dye correlates with a different color in our labeling scheme (see rectangular boxes). TAMRA, tetramethyl rhodamine. **(B)** Six DNA sandwich assays with corresponding target analysis systems. A<sub>10</sub> is an oligonucleotide tether with 10 adenosine units.



experiment, deviating by less than 2 cm<sup>-1</sup>. These consistent SERS signals from the Cy3-labeled nanoparticle probes allow us to use the Raman spectrum of Cy3 as a spectroscopic fingerprint to monitor the presence of a specific target oligonucleotide strand.

Dyes other than Cy3 can be used to create a large number of probes with distinct and measurable SERS signals for multiplexed detection. To demonstrate this point, we selected six commercially available dyes with distinct Raman spectra that can be incorporated into oligonucleotides through standard automated DNA syntheses. Six types of Raman-labeled and oligonucleotide-modified Au nanoparticle probes were prepared with sequences that were respectively complementary to statistically unique 30- to 36-nucleotide sequences for (A) hepatitis A virus Vall7 polypeptide gene (HVA), (B) hepatitis B virus surface antigen gene (HVB), (C) human immunodeficiency virus (HIV), (D) Ebola virus (EV), (E) variola virus (smallpox, VV), and (F) *Bacillus anthracis* (BA) protective antigen gene (Fig. 2) (11).

Eight separate tests were carried out to evaluate the selectivity of the system and our ability to determine the number and types of strands in solutions containing mixtures of the different targets (Figs. 2 and 3). The concentrations of the target strands were kept constant for all of these experiments (100 pM each), and the hybridization conditions were as described above. In the first test (Fig. 3, row 1), all spots show the same intense gray color associated with Ag deposition. However, they can be differentiated simply by using the Raman scanning method. Once the spectroscopic fingerprint of the Ag-containing



**Fig. 3. (A)** Flatbed scanner images of Ag-enhanced microarrays and **(B)** corresponding Raman spectra. The colored boxes correlate with the color-coded Raman spectra in Fig. 2. No false-positives or false-negatives were observed.

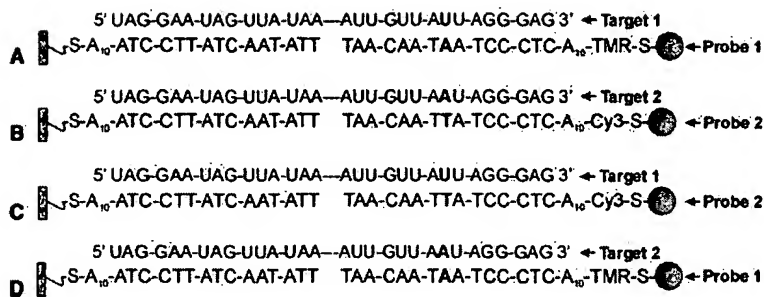
spot has been determined, the correct Raman label and, therefore, target sequence can be identified. To simplify the analysis, we assigned a color (rectangular box) to each Raman-labeled probe (Fig. 2A and Fig. 3B). In the first test (Fig. 3A), all six targets were present, and all showed strong gray-scale values when measured by means of the flatbed scanner as well as the expected Raman fingerprints. In the next seven tests, we systematically removed one or more of the targets to evaluate the suitability of this method for multiplexing. With the single-color gray-scale method one cannot determine if any cross-hybridization has occurred. However, with this "multiple color" scanning Raman method, one can carefully study the SERS spectra of each spot to determine which labels make up each spot. For the experiments described in Fig. 3, where the sequences are very dissimilar, we found that other than the expected spectroscopic probe signature for

each target, there were virtually no other detectable Raman lines, indicating no cross-hybridization between different targets and probes. The SERS signal was obtained only from areas of the substrate where the Raman dye-labeled Au particles have initiated Ag formation. Therefore, this "multiple color" scanning Raman detection method does not record background signal due to Ag deposition where Au particles do not exist. This is not the case for the previous gray-scale scanometric approach, especially at ultralow target concentrations ( $\leq 50$  fM) (1-3). The current unoptimized detection limit of this Raman scanning method is 20 fM (11).

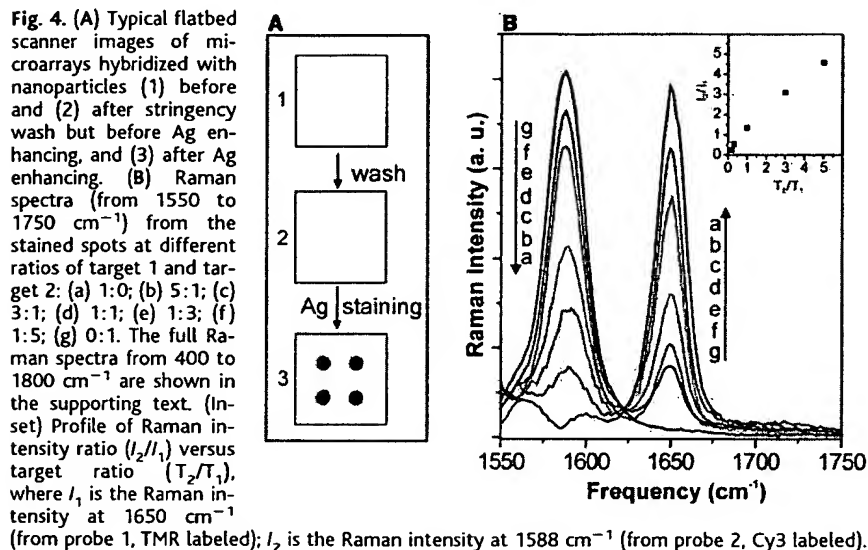
One would like to be able to use such detection systems to differentiate single nucleotide polymorphisms (SNPs), and in the case of gene expression studies, one would like access to RNA detection with single-spot signal ratioing capabilities. Nanoparticle probes heavily functionalized with oligonu-



# REPORTS



Scheme 2.



cleotides exhibit extraordinarily sharp thermally induced denaturation transitions that lead to substantially higher selectivity than conventional molecular fluorophore probes and microscopic bead probes in DNA detection (1, 19). However, thus far the behavior of these probes in the context of RNA detection has not been explored. To further test the selectivity of this Raman-based system and its ability to identify SNP targets, we chose two RNA targets that can bind to the same capture-strand DNA but have a single-base mutation in the probe-binding regions (target 1: T<sub>1</sub>, normal; target 2: T<sub>2</sub>, single-base difference) (Scheme 2). Therefore, two DNA-functionalized nanoparticle probes (probe 1: P<sub>1</sub>, probe 2: P<sub>2</sub>), which differ in sequence and Raman label, are required to differentiate these two RNA target strands (Scheme 2). Seven separate tests were performed to show not only how the two targets (T<sub>1</sub> and T<sub>2</sub>) can be differentiated, but also how mixtures of the two targets can be analyzed in semiquantitative fashion.

In each of these tests, a slide was treated with a 0.3 M NaCl PBS buffer solution containing T<sub>1</sub> and T<sub>2</sub> in different ratios (total concentration = 1 nM) in a humidity chamber. After 2 hours, the chip was washed with a 0.3

M NaCl PBS buffer to remove nonspecifically bound target. Then, the chip was treated with nanoparticle probes (P<sub>1</sub> and P<sub>2</sub> at 1:1 ratio, 2 nM total concentration) for 1.5 hours to effect hybridization with the overhanging region of the target sequences (Scheme 2). The chip was washed with 0.3 M NaNO<sub>3</sub> PBS buffer solution to remove chloride ions and nonspecifically bound nanoparticle probes. There are four possible hybridization modes, namely, T<sub>1</sub>:P<sub>1</sub>, T<sub>2</sub>:P<sub>2</sub>, T<sub>1</sub>:P<sub>2</sub>, and T<sub>2</sub>:P<sub>1</sub> (Scheme 2). When the chip was developed by Ag enhancing without a previous stringency wash, the Raman measurements on the gray spots, which correspond to different solution target ratios, yielded nearly identical spectra in all seven experiments; these spectra also are almost identical to those obtained for a sample containing a 1:1 ratio of probe 1 and probe 2 (11). These data show that probe 1 and probe 2 are bound to the spots on the chip in equal amounts, regardless of the target composition on the spot.

To identify the target composition on the spots, one must apply a salt- or temperature-based stringency wash (1, 19). Accordingly, we used a salt stringency wash (8 mM NaCl PBS buffer) to selectively denature the imperfect duplexes (T<sub>1</sub>:P<sub>2</sub> and/or T<sub>2</sub>:P<sub>1</sub>) (Scheme 2, C and D) but not the duplexes

formed from the perfectly complementary oligonucleotides (T<sub>1</sub>:P<sub>1</sub> and/or T<sub>2</sub>:P<sub>2</sub>) (Scheme 2, A and B). After stringency wash and subsequent Ag staining, the Raman analysis of the gray spots can be used to readily identify the target composition on the spots by their spectral fingerprints. In tests where only pure RNA target 1 or 2 is present, only signals for probe 1 or 2, respectively, were observed (compare Fig. 4B, "a" and "g") (11). In the case of mixtures, signals for both probes (I<sub>1</sub> at 1650 cm<sup>-1</sup> from probe 1 and I<sub>2</sub> at 1588 cm<sup>-1</sup> from probe 2) were detected, and the intensity ratios are proportional to the ratios of the two targets in each experiment (Fig. 4B, inset).

Compared with fluorescence-based chip detection, this nanoparticle-based methodology offers several advantages. The ratio of Raman intensities can be extracted from a single Raman spectrum with single-laser excitation. Second, the number of available Raman dyes is much greater than the number of available and discernable fluorescent dyes (7, 9). Indeed, a Raman dye can be either fluorescent or nonfluorescent, but a minor chemical modification of a dye molecule can lead to a new dye with a different Raman spectrum even though the two dyes exhibit virtually indistinguishable fluorescence spectra (7). Therefore, this fingerprinting method offers potentially greater flexibility, a larger pool of available and nonoverlapping probes, and higher multiplexing capabilities than conventional fluorescence-based detection approaches. Finally, the method incorporates all of the previous advantages of Au-nanoparticle based detection, including several orders of magnitude higher sensitivity and many orders of magnitude higher selectivity than the analogous molecular fluorescence-based approach (1, 19). When considered with previous demonstrations of the unique properties of nanoparticle probes (1-4, 19-27), a strong argument is being made for nanoparticles as the next-generation labeling technology for biddiagnostic research.

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**Supporting Online Material**  
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 Materials and Methods  
 Schemes S1 and S2  
 Figs. S1 to S3

12 June 2002; accepted 31 July 2002

# Fluidity of Bound Hydration Layers

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We have measured the shear forces between solid surfaces sliding past each other across aqueous salt solutions, at pressures and concentrations typical of naturally occurring systems. In such systems the surface-attached hydration layers keep the compressed surfaces apart as a result of strongly repulsive hydration forces. We find, however, that the bound water molecules retain a shear fluidity characteristic of the bulk liquid, even when compressed down to films  $1.0 \pm 0.3$  nanometer thick. We attribute this to the ready exchange (as opposed to loss) of water molecules within the hydration layers as they rub past each other under strong compression.

The presence of water molecules tightly bound to ions or ionized surfaces in aqueous electrolytes leads to strong repulsion when they approach each other to within a few nanometers or less (1–4). This effect is thought to arise from the reluctance of the ions or surfaces to shed their hydration sheath (3–6). It can dominate the double-layer repulsion/van der Waals attraction mechanisms [accounted for in the classic DLVO (Derjaguin, Landau, Verwey, and Overbeek) theory (7)] and is particularly important at the high salt concentrations ( $\sim 0.1$  M salt) found in nature. The way in which the properties of such hydration layers differ from those of bulk water has for decades excited much debate (8–11). At issue here is a simple question: Is the hydration layer surrounding such highly confined bound ions fluid, or is it highly viscous? The difference is crucial and is directly implicated in areas ranging from clay plasticity (12) and biolubrication (13) to gating of charge migration in DNA (14). In addition, many biological processes require shear and displacement of the final sub-nanometer layers of bound hydration layers before molecular contact or passage. These include interactions between ligands and receptors, transport within the very crowded

intracellular environment (15) or through ion channels (16), and protein folding (17).

Extensive direct measurements, as well as modeling (1–4, 6), have shed much light on equilibrium interactions of such bound hydration layers. In contrast, few direct measurements have been reported concerning their fluidity (18–22), particularly in the regime of the hydration sheaths, i.e., films of thickness  $D = 7$  to  $10$  Å (23–25). We used a surface force balance (SFB) with extreme sensitivity in measuring shear interactions to probe directly the fluidity of aqueous electrolytes compressed and sheared between molecularly smooth mica surfaces. While our results confirm the long-established equilibrium hydration repulsion, they reveal at the same time that the bound water in the hydration layers remains extremely fluid under shear. This fluidity persists down to films in the range  $D = D_c = 1.0 \pm 0.3$  nm, a thickness comparable to the size of hydrated ions in solution. Within such films, most of the confined water molecules are expected to be in bound hydration layers.

The SFB used has been described in detail (26). Its main features are schematically outlined in Fig. 1. We focus here on investigations of NaCl solutions, although preliminary studies on  $\text{KNO}_3$  solutions (in the hydration repulsion regime) reveal very similar findings. The following results are based on several different experiments (different pairs of mica sheets), as well as on different contact

positions within an experiment. Initial measurements in salt-free water were found to be crucial to establish the integrity and purity of the system. They were made to ensure the removal of any contaminant layers that adsorb on the mica while exposed to air (2, 27, 28), so as to attain true (mica-lattice/mica-lattice) contact between the surfaces (29). When the above behavior (29) could not be reproduced, as in our own earlier studies (30), subsequent measurements at high salt concentrations revealed high effective viscosities already at values of  $D$  as low as  $< 2$  to  $3$  nm, and these were attributed to contamination. A previous observation (31, 32) of comparably high viscosities in salt solutions ( $\sim 0.03$  M) confined to  $D < 2$  to  $2.5$  nm may have been related to this. Improvements in water purification and handling in the present study resolved this problem, as shown in figure 1 of (33) and in Fig. 1 of this study.

High-purity NaCl was then added to a concentration of  $10^{-3}$  M ( $\pm 10\%$ ), and normal and shear forces were measured as a further control. Mica loses  $\text{K}^+$  ions to solution, leaving a net negative surface charge, and the resultant distribution of ions in the intersurface gap leads to a long-ranged osmotic repulsion followed by a jump-in to adhesive mica/mica contact, in close agreement with earlier studies (3, 4) and in accord with DLVO theory (7) (Fig. 1). Such total extrusion of the low-salt electrolyte from between the adhering surfaces resembles that observed in salt-free water (33) and is thought to arise when the predominant hydroxonium  $\text{H}_3\text{O}^+$  ions condense into the charged mica, retaining no hydrated layers at the surface (3, 4).

Shear forces were measured as described recently (33). With the surfaces compressed down to separations of a few nm, the upper mica surface is made to move laterally back and forth, exactly parallel to the lower one at velocity  $v_x$  (Fig. 1 inset, upper trace). The shear forces  $F_s$  transmitted across the intersurface gap are simultaneously recorded as the surfaces further approach under slow thermal drift. No shear forces greater than the noise-limited sensitivity  $\delta F_s$  ( $\pm 30$  nN) are detected between the surfaces down to adhe-

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## VOLUME 25

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THE BUREAU OF NATIONAL AFFAIRS, INC.  
Washington, D.C.

U.S. Patent and Trademark Office  
Board of Patent Appeals and Interferences

Ex parte Nesbit

No. 91-2934

Decided June 25, 1992

Released September 21, 1992

### PATENTS

#### 1. Patentability/Validity — Anticipation — Double patenting (§115.0708)

Use of "two-way" patentability determination does not apply to every obviousness-type double patenting situation, but is limited to fact situations in which it is not applicant's fault that later-filed application issues while earlier-filed application is still pending and claims of later-filed application are not obvious, considered with or without other prior art, from claims of earlier-filed application; rejection of claims for illuminated basketball backboard for obviousness-type double patenting can be sustained, therefore, in view of "one-way" obviousness of claims of application over claims of patent.

#### 2. Patentability/Validity — Anticipation — Double patenting (§115.0708)

Law of obviousness-type double patenting requires only determination of whether any claim in application defines merely obvious variation of invention claimed in prior issued patent, assuming common ownership and/or same inventive entity.

Appeal from final rejection of claims (Paul E. Shapiro, primary examiner).

Application for patent filed March 30, 1990, by Charles E. Nesbit and Mark S. Nesbit, serial no. 501,483, a continuation-in-part of serial no. 327,597, filed March 23, 1989, now abandoned (illuminated basketball backboard). From rejection of basketball backboard claim, applicant's appeal. Affirmed; Stoner, examiner-in-chief, dissenting in separate opinion.

William H. Wright, of Henderson & Sturm, Washington, D.C.; Richard L. Fix, of Henderson & Sturm, Des Moines, Iowa, for appellants.

Before Calvert, vice chairman, and Boler, Stahl, Stoner, and Lyddane, examiners-in-chief.

Lyddane, examiner-in-chief.

This is a decision on an appeal from the final rejection of claims 1 through 15, which are all of the claims in the application.

The subject matter on appeal is directed to the combination of a basketball backboard and basketball rim with illumination means contained within the rim or portions of the backboard or both. The combination further includes switching means for the illumination means and/or light detection means operable to override the switching means in response to a sensed lighting condition. Claims 1 and 13 are descriptive of the invention and read as follows:

1. In a basketball backboard and basketball rim combination an improvement comprising:

an illumination means in the form of illumination lights contained within both the basketball rim and portions of the basketball backboard wherein both said rim and backboard are provided with transparent surfaces that will permit the transmission of light from the said illumination lights;

switching means for controlling the on/off actuation of said illumination means; and

light detection means operable to override the said switching means in response to a sensed condition.

13. In a basketball backboard and basketball rim combination an improvement comprising:

an illumination means in the form of illumination lights contained within both the basketball rim and portions of the basketball backboard wherein both said rim and backboard are provided with transparent surfaces that will permit the transmission of light from the said illumination lights; and

switching means for controlling the on/off actuation of said illumination lights; wherein, the switching means includes time delay means for controlling the on/off actuation of said illumination lights.

The references of record relied upon by the examiner in rejections of the claims under the judicially created doctrine of obviousness-type double patenting and under 35 USC 103 are:

Rydborn	3,648,107	Mar. 7, 1972
Zapco	3,825,261	July 23, 1974
Fox	4,248,010	Feb. 3, 1981
Kutnyak	4,431,196	Feb. 14, 1984
Pollock	4,736,955	Apr. 12, 1988
Newcomb et al.	4,846,475	July 11, 1989
(Newcomb)		(filed Jan. 25, 1988)

Best 4,858,920 Aug. 22, 1989  
(filed Aug. 12, 1988)  
Nesbitt et al. 4,984,787 Jan. 15, 1991  
(Nesbitt)

Porter Athletic Equipment Co. Catalog (1971).

Claims 13 and 14 stand rejected under 35 USC 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which appellants regard as the invention.

Claims 13 through 15 stand rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 2 and 6 of appellants' prior U.S. Patent No. 4,984,787.

Claims 1 through 12 stand rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1 through 6 of appellants' prior U.S. Patent No. 4,984,787 in view of Rydborn.

Claims 1 through 15 stand rejected under 35 USC 103 as being unpatentable over the Porter Athletic Equipment reference in view of Newcomb, Pollock, Kutnyak, Fox, Zapos, Best and Rydborn.

Rather than reiterate the examiner's statement of the above rejections and the conflicting viewpoints advanced by the examiner and the appellants, we refer to: pages 3 through 10 of the examiner's answer, to pages 11 through 15 of the appellants' brief and to appellants' reply brief for the full exposition thereof.

# OPINION

In arriving at our decision in this appeal, we have given careful consideration to appellants' specification and claims, to the applied prior art, and to the respective positions advanced by the appellants in the brief and reply brief and by the examiner in the answer. Upon evaluation of all the evidence before us, it is our conclusion that the examiner's rejection of appealed claims 13 and 14 under 35 USC 112, second paragraph, is

<sup>1</sup> We note that the examiner's statement of this rejection and the above rejection are couched as "provisional" rejections, utilizing the numbering of the claims as they appeared in the application, which is appropriate prior to the time the patent issues. However, the patent issued on January 15, 1991. Thus the obviousness-type double patenting rejections of the claims on appeal are no longer provisional, and we have identified the patent claims which correspond to the indicated application claims.

proper, but that the rejection of appealed claims 1 through 15 under 35 USC 103 is not. We also consider the examiner's rejections of appealed claims 1 through 15 under the judicially created doctrine of obviousness-type double patenting to be appropriate. Our reasoning for this determination follows.

Considering first the rejection of claims 13 and 14 under 35 USC 112, second paragraph, we observe that the appellants concede "that an exact duplication of the language of claims 13 and 14 exists" (brief, page 14). We agree and sustain the examiner's rejection for that reason.<sup>2</sup>

We next consider the rejection of claims 1 through 15 under 35 USC 103. In our evaluation of this rejection, we have carefully evaluated all the applied references and have considered all of the disclosure of each reference for what it would have fairly taught one of ordinary skill in the art. See *In re Boe*, 355 F.2d 961, 148 USPQ 507 (CCPA 1966). Additionally, we have taken into account not only the specific teachings of each reference, but also the inferences which one skilled in the art would have reasonably been expected to draw from the disclosure. See *In re Preda*, 401 F.2d 825, 159 USPQ 342 (CCPA 1968).

As a consequence of our review, we agree with the examiner that the Porter Athletic Equipment reference discloses steel basketball rims used with glass backboards, that the patents to Newcomb and Pollock suggest illumination of targets for night or low light play, that the patents to Fox and Kutnyak disclose the conventionality of utilizing electric light sources in game devices to permit night or low light play, that the patents to Zapos and Best provide transparent portions on goal structures to provide protection for light sources mounted therein, and that the patent to Rydborn discloses the use of light detection means operable to override a switching means for an illumination means in response to ambient light levels. However, we do not agree with the examiner that one having ordinary skill in the art would have found it obvious to have combined this mosaic of teachings in the manner proposed in the rejection of the claims on appeal.

The initial burden of establishing a basis for denying patentability to a claimed invention rests upon the examiner. *In re Piatecki*,

<sup>3</sup> Although we understand that the presence of identical claims in an application may render the claimed invention as a whole confusing and unclear, the examiner did not follow the procedure set forth in Section 706.03(k) of the MPEP, i.e., reject the second claim once the first claim is found allowable.

745 F.2d 1468, 223 USPQ 785 (Fed. Cir. 1984). In establishing a *prima facie* case of obviousness under 35 USC 103, it is incumbent upon the examiner to provide a reason why one of ordinary skill in the art would have been led to modify a prior art reference or to combine reference teachings to arrive at the claimed invention. *Ex parte Clapp*, 227 USPQ 972 (BPAI 1985). To this end, the requisite motivation must stem from some teaching, suggestion or inference in the prior art as a whole or from the knowledge generally available to one of ordinary skill in the art and not from appellants' disclosure. See, for example, *Uniroyal Inc. v. Rudkin-Wiley Corp.*, 837 F.2d 1044, 5 USPQ2d 1434 (Fed. Cir. 1988).

As stated in *W. L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983),

[t]o imbue one of ordinary skill in the art with knowledge of the invention in suit, when no prior art reference or references of record convey or suggest that knowledge, is to fall victim to the insidious effect of a hindsight syndrome wherein that which only the inventor taught is used against its teacher.

It is our conclusion that the only reason to combine the teachings of the applied references in the manner proposed by the examiner results from a review of appellants' disclosure and the application of impermissible hindsight. Thus, we cannot sustain the examiner's rejections of appealed claims 1 through 15 under 35 USC 103.

This leaves for our consideration the obviousness-type double patenting rejections of claims 13 through 15 based on claims 2 and 6 of appellants' prior U.S. Patent No. 4,984,787 and of claims 1 through 12 based on claims 1 through 6 of appellants' prior patent in view of Rydborn. The appellants have merely argued that

double patenting does not exist due to the presence of different structural limitations relating to both the location and type of switch employed (brief, page 14). Appellants have not indicated what the alleged "different structural limitations" are and have not presented any arguments as to the unobviousness of such differences. We have compared the claims on appeal with the claims of appellants' prior patent, and we deem such differences to be merely obvious variations of appellants' prior claimed invention considered alone (claims 13 through 15) or considered with the teaching of the light detection means of Rydborn (claims 1 through 12). We do not find any evidence in the record to show that the subject matter recited in the claims of the patent would have

been obvious from the claims of the application. However, we conclude that the obviousness-type double patenting rejection should be sustained in view of the "one-way" obviousness of the claims of the application over the claims of the patent.

[I]f we reach this conclusion with full knowledge of the decision of the Court of Appeals for the Federal Circuit in *In re Braat*, 937 F.2d 589, 19 USPQ2d 1289 (1991) where the court applied a "two-way" patentability determination in reversing a decision rejecting claims under the judicially created doctrine of obviousness-type double patenting. However, the facts in *Braat* were decidedly different than those in the present case. *Braat* involved an application of Braat and a patent to Dil which were commonly owned (by Philips). The Dil application was filed subsequent to the Braat application and, in fact, disclosed not only his own invention but also that of Braat, and recognized that the combination of the two inventions is particularly useful. The Dil patent included claims specific to his improvement as well as dependent claims directed to the combination.

The court held in *Braat* that the Dil invention was separate from that of Braat and conceivably could have been developed earlier than that of Braat, and as such, it was not necessarily an "improvement". The court thus characterized the inventions of Dil and Braat as separate subcombinations that Dil then combined to form a third invention.

The court noted in its opinion at 19 USPQ2d 1291 that [o]bviousness-type double patenting is a judicially created doctrine intended to prevent improper timewise extension of the patent right by prohibiting the issuance of claims in a second patent which are not "patentably distinct" from the claims of a first patent. See *In re Longi*, 759 F.2d 887, 892, 225 USPQ 645, 648 (Fed. Cir. 1985). The doctrine has also been phrased as prohibiting claims in the second patent which define "merely an obvious variation" of an invention claimed in the first patent. *In re Vogel*, 422 F.2d 438, 441, 164 USPQ 619, 622 (CCPA 1970). [emphasis in original]

Although the court subsequently stated at 19 USPQ2d 1292 in the same opinion that [t]he crux of this appeal comes down to whether the Board erred in applying a "one-way" patentability determination instead of a "two-way" determination, it is our view that the court found the reasoning of *Borah*. [*In re Borah*, 354 F.2d 1009, 148 USPQ 175 (CCPA 1966)] to be controlling. The court noted at 19 USPQ2d

1293 that the assignee (Philips) of the Dil patent and Braat application could not have included the claims of Dil in the Braat application, for Braat did not invent the subject matter of the Dil claims.

... Nor could Philips have included the claims of Braat in the Dil application, for Dil did not invent the subject matter of the Braat application. Philips filed the Braat and Dil applications so as to maintain proper inventorship, with claims directed to Braat's "subcombination" invention in the first application and claims directed to both Dil's "subcombination" invention and to the "combination" invention in the second application. It is not *Phillips' [sic, Philips'] fault that the combination claims in the Dil patent issued first. Thus, a double patenting rejection is sustainable here only if claims 5/1 and 6/1 of Dil are not patentably distinct from the subject matter defined by the rejected claims of Braat, and the Board erred in sustaining the double patenting rejection without making such a "two-way" determination.* [emphasis added]

The Court acknowledged that allowance of the Braat application would result in a timewise extension of the patent protection of the Dil structure, but pointed out their prior holding in *In re Borah*, 354 F.2d at 1017, 148 USPQ at 220, "that as a matter of law the extension of protection objection is not necessarily controlling." The court then noted that the fundamental reason for the rule against double patenting, quoting from *In re Van Ornum*, 686 F.2d 937, at 943-944, 214 USPQ 761, at 766 (CCPA 1982), is to prevent unjustified timewise extension of the right to exclude granted by a patent no matter how the extension is brought about [emphasis in original] (quoting *In re Schneller*, 397 F.2d 350, 138 USPQ 210 (CCPA 1968)).

The court reasoned at 19 USPQ2d 1293 that only if the extension of patent right is unjustified is a double patenting rejection appropriate. There are situations where the extension is justified. [emphasis in original]

The court concluded that "[i]f his case presents such a situation" (emphasis ours). The decision in *Braat* has caused no little confusion for this board as well as for other members of the patent bar as to when the "two-way" test set forth in *Braat* must be applied. The dissent believes it to apply in every obviousness-type double patenting situation, while we would limit it to the facts in *Braat*.

In particular, we believe the court in *Braat* merely applied its reasoning in *Borah*, which dealt with a basic combination in a first filed application and an improvement in a second filed, first issued, application, to the facts in *Braat*, where the court found the first filed Braat application to be directed to a subcombination and the second filed, but first issued, Dil application to be directed to a second subcombination and a combination. It is our opinion that the court, in *Borah*, really applied a "one-way" test, but indicated it had to be in the right direction. The court stated that

It is our view that the "two-way" test revealed in *Braat*, or the "one-way" test applied in the right direction in *Borah*, is limited to fact situations such as these where it is not the fault of the applicant that a later filed application issues while an earlier filed application is still pending and the claims of the later filed application are not obvious, considered with or without other prior art, from the claims of the earlier filed application.

We do not have any similar fact situation present in the case before us. Appellants filed an application for a basic invention and a patent issued thereon. While that application was pending, appellants filed the instant combination-in-part application on an improvement of the basic invention, which is the usual "obviousness-type" double patenting situation (see *In re Schneller*, 397 F.2d 350, 138 USPQ 210 (CCPA 1968)).

The longstanding law on double patenting, both "same invention type" and "obviousness-type" double patenting, was restated in *In re Vogel*, supra. In this decision, the Court of Customs and Patent Appeals stated that once it is determined that the same invention is not being claimed twice, a "second analysis question" must then be asked:

[d]oes any claim in the application define merely an obvious variation of an invention disclosed and claimed in the patent? [emphasis added]

The court in *Vogel*, in affirming a rejection of claim 10 on the ground of "obviousness-type" double patenting, stated at 164 USPQ 623 that

[t]he only limitation appearing in claim 10 which is not disclosed in the available portion of the patent disclosure is the permeability range of the packaging material; but this is merely an obvious variation as shown by *Ellies*. The answer to the second analysis question, therefore, is yes, and the claim is not allowable in the absence of a terminal disclaimer. The correctness of this conclusion is demonstrated by observing that claim 10, by reciting "meat," includes pork. Its allowance for a full term would therefore extend the time of monopoly as to the pork process. [emphasis added]

We recognize, as has the dissent, that the court in *Vogel* continued in the succeeding sentence with the statement that

[i]t is further noted that viewing the inventions in reverse order, i.e. as though the broader claims issued first, does not reveal that the narrower (pork) process is in any way unobvious over the broader (meat) invention disclosed and claimed in the instant application. [emphasis added]

Contrary to the view of the dissent below, we do not find the court's reference to "viewing the inventions in reverse order" to be in any way a departure from the stated one-way test. The court in *Vogel* unequivocally determined that claim 10 was "merely an obvious variation" and then stated that such a claim "is not allowable in the absence of a terminal disclaimer." The court then asserted that the proof of the correctness of the preceding holding was that "allowance for a full term would therefore extend the time of monopoly as to the pork process."

We believe the statement which followed this clear holding, referring to viewing the inventions "in reverse order," was intended as an aside and merely to buttress the underlying position that claim 10 was "merely an obvious variation" of the prior patented subject matter. If the court in *Vogel* had intended to indicate the proper test was a two-way test, the additional view of the "reverse order" consideration would at least have been interjected prior to the court's conclusion that the claim was "not allowable in the absence of a terminal disclaimer" and certainly before its statement that the correctness of this conclusion is demonstrated by observing that claim 10, by reciting "meat," includes pork. Its allowance for a full term would therefore extend the time of monopoly as to the pork process" (emphasis added).

We observe that the Court of Appeals for the Federal Circuit, in *In re Longi*, supra, 225 USPQ at 648, determined that the judicially created doctrine of obviousness-type double patenting is based on the policy enunciated by Judge Rich in his concurring opinion in *In re Zickendraht*, 319 F.2d 225, 138 USPQ 22 (CCPA 1963) that

[t]he public should ... be able to act on the assumption that upon expiration of the patent it will be free to use not only the invention claimed in the patent but also any modifications or variants thereof which would have been obvious to those of ordinary skill in the art at the time the invention was made, taking into account the skill of the art and prior art other than the invention claimed in the issued patent. [emphasis in original]

The court in *Longi* continued that

[u]nder that facet of the doctrine of double patenting, we must direct our inquiry to whether the claimed invention in the application for the second patent would have been obvious from the subject matter of the claims in the first patent, in light of the prior art. [emphasis added]

citing *Carman Industries, Inc. v. Wahl*, 724 F.2d 932, 220 USPQ 481 (Fed. Cir. 1983).

<sup>1</sup> See Irving, Kaminski and Kordich, "DOUBLE PATENTING: ONE WAY, TWO WAYS: WHOSE 'DELAY?' from the Second Annual Continuing Legal Education Program on Patent Prosecution and Litigation, Akron, Ohio, April 24-25, 1992.



At this point, in footnote 5, the court in *Long* noted that

[i]n *Carman* [sic, *Carman*] Industries, involving a design patent, we added that a second patent would also be invalid if the first patent's claims would have been obvious from the claims of the second patent. [first emphasis added, others are in original]

The court, in the same footnote, chose not to address whether such a "two-way" requirement applies when the two applications under consideration are both utility applications.

[2] We maintain the position that the law of obviousness-type double patenting which predates, but was restated in, *Vogel* requires only the determination of whether any claim in an application defines merely an obvious variation of an invention claimed in a prior issued patent, assuming common ownership and/or same inventive entity. This is true notwithstanding the decision in *Braat* even if it is intended to restate the law to require a "two-way" test.

A panel of the Court of Appeals for the Federal Circuit is bound by prior precedential decisions of the Court of Customs and Patent Appeals. See *UMC Electronics Co. v. United States*, 816 F.2d 647, 2 USPQ2d 1465, n.6 at 1468 (Fed. Cir. 1987). The decisions of the CCPA, such as *Vogel* and *Long*, control because the CCPA always sat *en banc*. In *Restell*, 872 F.2d 1008, 10 USPQ2d 1614, at 1617 (Fed. Cir. 1989), and such decisions can only be overruled by the CAFC sitting *en banc*. *Racing Strollers Inc. v. TRI Industries Inc.*, 878 F.2d 1418, 11 USPQ2d 1300 (Fed. Cir. 1989) and *Johnston v. IVAC Corp.*, 885 F.2d 1574, 12 USPQ2d 1382 at 1386 (Fed. Cir. 1989). The Board of Patent Appeals and Interferences is obligated to follow the precedents of our reviewing court, but in turn, we must follow the precedents of earlier decisions of the CCPA unless and until they are overturned by the CAFC sitting *en banc*. Accordingly, this Board is constrained to follow the precedential decision in *Vogel*, and thus to determine whether the claims before us define merely an obvious variation of the invention claimed in appellants' prior patent, i.e., to apply a one-way test.

We are also fully cognizant of the decision in *Carman Industries, Inc. v. Wahl*, supra, wherein the court held that "obviousness-type" double patenting may exist between a design and a utility patent, stating at page 487 that

[d]ouble patenting may be found in a design/utility setting,

and that for the "obviousness-type" double patenting situation

the test is whether the subject matter of the claims of the patent sought to be invalidated would have been obvious from the subject matter of the claims of the other patent, and *vice versa*. [emphasis added]

We note that the court also stated on the same page that "[d]ouble patenting is rare in the context of utility versus design patents."

From the above, it is apparent that the court in *Carman* decided that a "two-way" test is required for determining "obviousness-type" double patenting in the *design/utility* setting. We do not think that the court in *Carman* intended to expand the "two-way" test to the utility/utility situation, and for the reasons noted above, the court could not have done so without sitting *en banc* for the purposes of overturning the precedential decision in *Vogel*. We further note that the decision in *Carman* was not even an unanimous decision of a three judge panel. Judge Nies concurring-in-part and stating

I do not agree that in obviousness-type double patenting each patent must be found obvious from the other. If one patent is obvious from the other and has the effect of extending its term, the second to issue is invalid.

In summary, it is our opinion that this board must follow the decision in *Vogel* and must reach a determination as to whether the claims in this application were properly rejected under the judicially created doctrine of obviousness-type double patenting based on whether the claims before us are merely an obvious variation of the invention claimed in appellants' prior patent. It is our conclusion that they are, and we shall thus sustain the examiner's rejections on this ground.

We make the following new rejection pursuant to the provisions of 37 CFR 1.196(b).

Claims 13 through 15 are rejected under 35 USC 103 as being unpatentable over *Best*. The patent to *Best* discloses a basketball backboard 20 and rim 12 combination including illumination means in the form of lights 32 contained within the rim. The rim 12 includes a transparent surface 36 that protects the lights while permitting transmission of light therefrom. The combination further includes switching means 22, 24, 40 including a time delay means in the timer 40 (column 3, lines 3 through 14). Thus, the patent to *Best* discloses every element of the claimed invention except that the illumination lights and transparent surfaces are provided within portions of the backboard. We observe that the purpose of the lighting system for the basketball rim of *Best* is to

provide flashing lights "to thereby visually announce with some fanfare the bypassage of the ball through the hoop" (column 1, lines 58 and 59). It is our opinion that one having ordinary skill in the art would have found it *prima facie* obvious to have modified the device of *Best* to include flashing lights with transparent protective covers on the backboard or any other adjacent area such as the scoreboard, support frame, etc., to increase the "fanfare" as the ball passes through the hoop. In our view, this is an obvious extension of the teaching of *Best* to provide flashing lights visible to the observer to evidence the scoring of a basket. We note that the law presumes skill on the part of the artisan rather than the converse. See *In re Sovish*, 769 F.2d 738, 226 USPQ 771 (Fed. Cir. 1985).

Accordingly, the decision of the examiner rejecting claims 13 and 14 under 35 USC 112, second paragraph, and rejecting claims 1 through 15 under the judicially created doctrine rejecting claims 1 through 15 under 35 USC 103 is reversed, and a new rejection of claims 13 through 15 under 35 USC 103 has been made pursuant to 37 CFR 1.196(b).

Any request for reconsideration or modification of this decision by the Board of Patent Appeals and Interferences based upon the same record must be filed within one month from the date hereof (37 CFR 1.197).

With respect to the new rejection under 37 CFR 1.196(b), should appellants elect the alternate option under that rule to prosecute further before the Primary Examiner by way of amendment or showing of facts, or both, not previously of record, a shortened statutory period for making such response is hereby set to expire two months from the date of this decision. In the event appellants elect this alternate option, in order to preserve the right to seek review under 35 USC 141 or 145 with respect to the affirmed rejection, the effective date of the affirmance is deferred until conclusion of the prosecution before the examiner unless, as a mere incident to the limited prosecution, the affirmed rejection is overcome.

If the appellants elect prosecution before the examiner and this does not result in allowance of the application, abandonment or a second appeal, this case should be returned to us for final action on the affirmed rejection, including any timely request for reconsideration thereof.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 CFR 1.136(a). See the final rule notice, 54 F.R. 29548 (July 13, 1989), 1105 O.G. 5 (August 1, 1989).

# **AFFIRMED** 37 CFR 1.196(b)

Stoner, examiner-in-chief, dissenting.

While I share my colleagues' views regarding the examiner's rejections under 35 USC 112, second paragraph, and 35 USC 103, and support the new ground of rejection of claims 13, 14 and 15 under 35 USC 103, I must respectfully dissent from that part of their decision affirming the rejection of claims 1 through 15 under the judicially created doctrine of obviousness-type double patenting.

Before *In re Braat*, 937 F.2d 589, 19 USPQ2d 1289 (Fed. Cir. 1991), I understood the decisions of the Court of Appeals for the Federal Circuit and one of its predecessors, the Court of Customs and Patent Appeals, to support the proposition that the test for obviousness-type double patenting was simply a one-way test. Although I think that the test ought to be a one-way test (at least where utility applications are involved), I do not share the majority's belief that the two-way test applied in *Braat* is limited to the facts of *Braat*.

Certainly, *Braat* is not the first decision to introduce a two-way test to double patenting law. The literal infringement test for same invention double patenting, stated in *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970), is, of necessity, a two-way test. The test for obviousness-type double patenting, as applied between a design and a utility patent, is likewise a two-way test. *Carman Industries, Inc. v. Wahl*, 724 F.2d 932, 220 USPQ 481 (Fed. Cir. 1983) (the test for obviousness-type double patenting "is whether the subject matter of the claims of the patent sought to be invalidated would have been obvious from the subject matter of the claims of the other patent, and vice versa"). *Carman Industries* relied principally upon *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969), another design-utility situation, in which the court referred to its practice of sanctioning double patenting rejections where the patent relied on and the application on appeal "involve inventions which are obvious variations of one another" (emphasis supplied).

Guided by the contrast between what was said in *Braat* and what was said in *In re Borah*, 354 F.2d 1009, 148 USPQ 213 (CCPA 1966), I believe that the court has long applied a two-way test in the obviousness-type double patenting situation without ever specifically saying so. I consider *Braat* to be binding precedent of general applica-

ity which makes explicit what was previously implicit and brings the test for obviousness-type double patenting into conformity with the two-way test applied in other areas of double patenting law.

Although many decisions have stated the test for obviousness-type double patenting, the principal case requiring attention is *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA, 1970), a decision which has been frequently cited for its restatement of the law of double patenting. In *Vogel*, the court provided an analytical framework for "obviousness-type" double patenting in the following terms:

The ... [relevant] analysis question is: Does any claim in the application define merely an obvious variation of an invention disclosed and claimed in the patent? In considering the question, the patent disclosure may not be used as prior art. ... We recognize that it is most difficult, if not meaningless, to try to say what is or is not an obvious variation of a claim. A claim is a group of words defining only the boundary of the patent monopoly. It may not describe any physical thing and indeed may encompass physical things not yet dreamed of. How can it be obvious or not obvious to modify a legal boundary? The disclosure, however, sets forth at least one tangible embodiment within the claim, and it is less difficult and more meaningful to judge whether that thing has been modified in an obvious manner.

If the answer to the ... question is no, there is no [obviousness-type] double patenting involved and no terminal disclaimer need be filed. If the answer is yes, a terminal disclaimer is required to prevent undue timewise extension of monopoly.

422 F.2d at 441-42, 164 USPQ at 622 (emphasis supplied).

In *Vogel*, the claims of the application on appeal related to a process of packaging meat generally (claims 7 and 10), although one claim was directed to a similar process specifically limited to beef (claim 11). The claim of the *Vogel* patent on which the double patenting rejection was based was directed to a process of packaging pork. Also in evidence was a prior art patent to Ellices teaching a meat-packaging material having the oxygen permeability range recited in the application claims. After determining that the same invention was not being claimed in both the application and the *Vogel* patent, the court proceeded to ask whether "any claim in the application define[s] merely an obvious variation of an invention ... claimed in the patent." The court answered this question in the negative as to the beef processing

claim 11, and concluded that claim 11 did not present any kind of double patenting situation. As to claims 7 and 10, however, the court stated:

Appealed claim 10 ... recites a process to be performed with "meat." "Meat" reads literally on pork. The only limitation appearing in claim 10 which is not disclosed in the available portion of the patent disclosure is the permeability range of the packaging material; but this is merely an obvious variation as shown by Ellices. The answer to the ... analysis question, therefore, is yes, and the claim is not allowable in the absence of a terminal disclaimer. The correctness of this conclusion is demonstrated by observing that claim 10, by reciting "meat," includes pork. Its allowance for a full term would therefore extend the time of monopoly as to the pork process. It is further noted that viewing the inventions in reverse order, i.e., as though the broader claims issued first, does not reveal that the narrower (pork) process is in any way unobvious over the broader (meat) invention disclosed and claimed in the instant application. The same considerations and result apply to claim 7.

422 F.2d at 442-43, 164 USPQ at 622-23 (emphasis supplied).

In *re Bora*, 354 F.2d 1009, 148 USPQ 213 (CCPA 1966) antedates *Vogel* and specifically deals with a situation in which delay in the Patent and Trademark Office (PTO) resulted in a later filed improvement patent issuing before an earlier filed basic invention. In *Bora*, patent claims 4 and 5 directed to an improvement on a basic invention were used as the basis for refusing claims to the basic invention for obviousness-type double patenting. The claims of the application on appeal were directed to a mold manipulating apparatus for use in conjunction with a press. The patent claims, on the other hand, were directed to a similar mold handling and operating apparatus improved by the addition of "spring kickers" and pressure equalizers. The patent on the improvement, although based on an application filed after the application date of the basic invention, gained prompt issuance and served as the basis for the examiner's rejection of the claims of the earlier filed application. Regarding the spring kickers, the board below reasoned that omission of the spring from the patent claim would have been obvious. The court exonerated the board for its method of analysis, saying:

We cannot accept this reasoning and the conclusion of no patentable difference to which it led. The obviousness is not a

question of omitting, but of adding spring kickers. The board seems to have been reasoning in reverse, treating the subject matter of the patent claims as if it were prior art and then reasoning that it would be obvious to omit the springs if a biasing force was not wanted.

... The obviousness issue turns on the addition of structure, the obviousness of the improvement defined in the patent claim, not the obviousness of the basic structure, given the improvement as prior art, which it is not. The board, moreover, seems to be applying the well known negative test for patentability, namely, that it cannot be based on the mere omission, from a prior art structure, of an element together with its function. We have no prior art here.

354 F.2d at 1018, 148 USPQ at 220-21 (emphasis in the original).

By virtue of its condemnation of one of the prongs of a two-way test (specifically the obviousness of omitting from a patent claim an element and its function), *Bora* unquestionably applies a one-way test, albeit one in which the claims of the patent are measured against the claims of the application, rather than vice versa. *Bora* accordingly supports the proposition, stated in *In re Braat*, 937 F.2d 589, 593, 19 USPQ2d 1289, 1292 (Fed. Cir. 1991), that:

[W]hen a later filed improvement patent issues before an earlier filed basic invention, a double patenting rejection is only proper against the claims to the basic invention if the improvement is not patentably distinct from the basic invention. The rationale behind this proposition is that an applicant (or applicants), who files applications for basic and improvement patents should not be penalized by the rate of progress of the applications through the PTO, a matter over which the applicant does not have complete control. ... In this situation, the order of issuance is, in effect, ignored, and the relevant determination becomes whether the improvement is patentably distinct from the generic invention.

On its face, the test stated in dicta in *Vogel* is simply a one-way test: the claims of the application are to be compared to those of the prior patent to determine whether any of the application claims define merely an obvious variation of the patent claims. The stated rationale is: the prevention of "undue

timewise extension of monopoly."<sup>4</sup> Reconsideration of the facts of *Vogel* in light of *Braat* and the manner in which the test in *Vogel* was actually applied, however, persuades me that the test was, in reality, two-way.

Had the *Vogel* court stopped before adding the "reverse order" passage which I have emphasized, I would agree that the test stated in *Vogel* is unequivocally a one-way test. That they did not stop, but went on to view the claims of the inventions "in reverse order," suggests to me that there was either doubt or a lack of unanimity as to the correctness of the literal words of the analysis question they had framed. But for the "reverse order" language at the end of *Vogel*, one can easily harmonize *Vogel* and *Bora*, understanding the test in the case of utility applications involving a basic invention and an improvement thereon to be a one-way test in which the claims of the application are compared to those of the patent, except where delays in the PTO not under the applicant's control obtain, necessitating that the claims of the patent be compared to those of the application.<sup>5</sup> One is even tempted to dismiss the "reverse order" language at the end of *Vogel* as being surplusage or a product of excess caution on the part of the court in attempting to demonstrate to the appellant that no matter how viewed, the obviousness-type double patenting rejection was proper.<sup>6</sup> For me, however, *Braat* has removed that possibility.

As the majority has already noted, *Braat* involved an application of *Braat* and a patent to *Dil* which were commonly owned. *Dil*'s application was filed subsequent to *Braat*'s. Both were concerned with optical record carriers having information carried on tracks, the tracks being composed of information areas defined by pits separated from one another by intermediate regions or lands. In order to increase the amount of information which can be stored on a record carrier

<sup>4</sup>The court has indicated its preference for the more accurate, and less emotion generating expression "extension of patent rights." *In re Kaplan*, 789 F.2d 1574, 229 USPQ 678 (Fed. Cir. 1986).

<sup>5</sup>In this regard, see *General Foods Corp. v. Studiengesellschaft Kohle mbH*, 765 F.Supp. 121, 20 USPQ2d 1673 (S.D.N.Y. 1991), decided May 30, 1991, less than a month before *Braat*, in which the court did essentially that.

<sup>6</sup>It might be argued that the court was merely trying to demonstrate that a change in order of issuance would not have altered the result. I see no reason for it to have done so, however, since that would have amounted to an advisory ruling on a situation not before the court.

while at the same time avoiding "cross-talk" resulting from the proximity of adjacent tracks, Braat disclosed alternating the phase depth of adjacent tracks. Dil, while concerned with controlling phase depth of information areas on record carriers, was primarily concerned with the effect of the angle of the side walls of the information area on side depth. Dil's invention employed V-shaped grooves functioning as information areas. Dil also recognized that his V-shaped grooves could be advantageously combined with Braat's invention, whose earlier filed patent application he referenced, in an embodiment wherein alternating track portions have different phase depths and the information areas have angled side walls. Dil's independent claim 1 was directed to a record carrier having angled side walls, while dependent claims 5/1 and 6/1 added the alternating phase depth structure. A panel of this board sustained the rejection of Dil's claims on the basis of obviousness-type double patenting over Dil's dependent claims 5/1 and 6/1.

In its decision, the court stated:

The crux of this appeal comes down to whether the Board erred in applying a "one-way" patentability determination instead of a "two-way" determination. The Board correctly found that the rejected claims of Braat are merely obvious variations of the invention described by dependent claims 5/1 and 6/1 of Dil. The only difference between the claims of Braat and claims 5/1 and 6/1 of Dil is the omission of the requirement in the claims of Dil of information areas having side walls which are angled at a particular angle, and we do not think that omission of such a limitation in the present case would constitute an unobvious modification. The issue is whether the Board erred in concluding that such a one-way determination was all that was necessary or whether it was necessary to also determine whether the claims of Dil are patentably distinct from the invention described by the rejected claims of Braat; i.e., whether the addition in the claims of Dil of side walls which are angled at a particular angle was merely an obvious modification over the invention claimed in Braat.

937 F.2d at 593, 19 USPQ2d at 1292 (emphasis in the original).

As the majority points out, the court did indeed indicate that the Dil invention was separate from that of Braat and conceivably could have been developed earlier than that of Braat, and as such, Dil's invention was not necessarily an "improvement" of Braat's invention. The court characterized the inventions of Dil and Braat as separate subcom-

binations "which are described by their respective independent claims" that Dil then combined to form a third invention, a combination described by dependent claims 5/1 and 6/1 of Dil. This characterization was in response to the attempt of the assignee to characterize Dil's invention as an improvement over Braat, in an effort to analogize the situation in Braat to that in *Borah*.

None of this changes the fact that Dil's combination invention, which was necessarily later in time than that of Braat and which had a later application filing date than did Braat's application, issued as a patent before Braat, creating a situation precisely like that in *Borah*. If *Borah* were still good law in its entirety, that is, if the test to be applied was one-way, the court could have and should have simply applied that same one-way test and in the same direction as in *Borah*, in which case Dil's patent claims 5/1 and 6/1 would have been compared against the claims of the Braat application to determine whether Dil's claims were obvious over Braat's claims. Doing so (i.e., applying a one-way test as in *Borah*), they would have avoided treating Dil's patent claims 5/1 and 6/1 as prior art, which they are not so far as Braat is concerned. The same result would have been produced as has been produced by the application of the two-way test. It appears to me that the only reasonable explanation for not following *Borah* is that the court has concluded that the test to be applied in obviousness-type double patenting situations is necessarily a two-way test.

The majority is of the view that the court in Braat found the "reasoning of *Borah*" to be controlling. To this end they quote Braat to the effect that the assignee (Philips) of the Dil patent and Braat application

could not have included the claims of Dil in the Braat application, for Braat did not invent the subject matter of the Dil claims. . . . Nor could Philips have included the claims of Braat in the Dil application, for Dil did not invent the subject matter of the Braat application. . . . Philips filed the Braat and Dil applications so as to maintain proper inventorship, with claims directed to Braat's "subcombination" invention in the first application and claims directed to both Dil's "subcombination" invention and to the "combination" invention in the second application. . . . It is not Philips' [sic, Philips] fault that the combination claims in the Dil patent issued first. Thus, a double patenting rejection is sustainable here only if claims 5/1 and 6/1 of Dil are not patentably distinct from the subject matter defined by the rejected claims of Braat, and the Board erred in

sustaining the double patenting rejection without making such a "two-way" determination. [emphasis added]

The majority fails to say why the court did not simply follow the test of *Borah*, rather than its reasoning. I believe that the court did not follow *Borah*'s test because it had already departed from the one-way test necessarily present in that case as early as the time of *Vogel*.

The majority correctly points out that *Carman Industries* involved "obviousness-type" double patenting in the design/utility setting and notes that the three judge panel of the court could not have extended the two-way test to a utility situation without sitting *en banc* for the purposes of overturning the precedential decision of *Vogel*.<sup>1</sup> The answer to this is that *Vogel*'s test is, in reality, not a one-way test, for the reasons noted above. There was nothing in *Vogel* to overturn; the portion of the decision which "restated" the test for obviousness-type double patenting is simply dicta.

Because I consider the court to have made clear that the appropriate test is a two-way test, I am compelled to the conclusion that the examiner's rejection of claims 1 through 15 on the basis of the judicially created doctrine of obviousness-type double patenting cannot be sustained. Assuming the correctness of the majority's determination that claims 13 through 15 of the application are obvious variations over claims 2 and 6 of the appellants' prior patent and that application claims 1 through 12 are obvious variations over claims 2 and 6 of the appellants' prior patent in view of Rydborn, I nevertheless see no basis for concluding that patent claims 2 and 6 are obvious variations over the claims of the application. Pate claims 2 and 6 specifically require, by virtue of their incorporation of the language of respective parent claims 1 and 5, that the switching means include "pressure sensitive means located on the face of the backboard for controlling the on/off actuation of said illumination lights." Nothing in the claims of the application or in any of the cited prior art would have made obvious the addition to the structure defined

<sup>1</sup> The majority also points out that the decision in *Carman Industries* was not unanimous, Judge Nies concurring-in-part and stating, "I do not agree that in obviousness-type double patenting each patent must be found obvious from the other. If one patent is obvious from the other and has the effect of extending its term, the second to issue is invalid."

Be that as it may, Chief Judge Nies was part of the unanimous panel which decided *Braat*.

by the application claims of pressure sensitive means on the face of the backboard for the stated purpose.



LEXSEE

IN RE HANS OETIKER

91-1026

UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT

977 F.2d 1443; 1992 U.S. App. LEXIS 25784; 24 U.S.P.Q.2D (BNA) 1443; 93  
Daily Journal DAR 658

October 13, 1992, Decided

**PRIOR HISTORY:** [\*\*1] Appealed from: U.S. Patent  
& Trademark Office Board of Patent Appeals & Interfer-  
ences

**DISPOSITION:** REVERSED.

**CASE SUMMARY:**

**PROCEDURAL POSTURE:** Appellant sought review of a decision of the United States Patent and Trademark Office Board of Patent Appeals and Interferences, which held that all of the claims in his patent application were unpatentable under 35 U.S.C.S. § 103.

**OVERVIEW:** The United States Patent and Trademark Office Board of Patent Appeals and Interferences (Board) denied appellant's application for a patent on an improvement to a metal hose clamp, generally described in an earlier patent already belonging to appellant. Appellant contended that the improvement described as a pre-assembly hook, served both to maintain pre-assembly condition of clamp, and to disengage automatically when clamp was tightened. The Board stated in its brief on appeal that a disengageable catch, such as that used by appellant, was a common everyday mechanical concept that was employed in door latches, and electrical and other switches. However, the Board failed to cite any references. While judicial notice of common everyday mechanical concepts could have been taken in appropriate circumstances, the Board did not explain why a "catch" of unstated structure in an electrical switch, for example, was such a concept that made appellant's invention obvious.

**OUTCOME:** The court reversed the rejection of appellant's claims.

**CORE TERMS:** examiner, invention, patent, prima facie case, obviousness, teaching, prima facie, skill, clamp, combined, garment, chemical, inventor, patentability, motivation, combine, burden of persuasion, reconsideration, solve, initial burden, new evidence, mechanical, hook and eye, unpatentable, fastener, artisan, hook, hose, preponderance of evidence, rebuttal evidence

**COUNSEL:** Paul M. Craig, Jr., of Washington, D.C., argued for appellant.

John W. Dewhirst, Office of the Solicitor, of Arlington, Virginia, argued for appellee. With him on the brief were Fred E. McKelvey, Solicitor and Robert d. Edmonds, Associate Solicitor.

**JUDGES:** Before NIES, Chief Judge, NEWMAN and PLAGER, Circuit Judges.

**OPINIONBY:** NEWMAN

**OPINION:** [\*1444]

NEWMAN, Circuit Judge.

Hans Oetiker appeals the decision of the United States Patent and Trademark Office Board of Patent Appeals and Interferences, holding unpatentable claims 1-14 and 16-21, all of the claims in patent application No. 06/942,694. n1 Oetiker appeals on procedural and substantive grounds.

n1 Ex parte Oetiker, No. 89-2230 (Bd. Pat. App. & Interf. May 31, 1990; on reconsideration, August 23, 1990).

## I

### PROCEDURE

#### Background

All of the claims were finally rejected for obviousness in terms of 35 U.S.C. § 103. The Board, upholding the rejection, stated that "the [\*\*2] examiner has . . . established a prima facie case of obviousness . . . which is un rebutted by any objective evidence of nonobviousness". Oetiker stated that this Board holding was the first rejection of his claims for being "prima facie obvious", and filed rebuttal evidence with a petition for reconsideration. The Board declined to consider the new evidence or change its decision.

Oetiker states that a holding of prima facie obviousness means, in patent examination, that the claimed invention is subject [\*1445] to a rebuttable presumption of obviousness; that is, if the applicant can provide evidence or argument in support of unobviousness, such evidence and argument will be considered, and the question of patentability will be redecided on the entire record. Oetiker states that a rejection made in the words "prima facie obvious" is understood by patent examiners and practitioners as an invitation to provide such rebuttal evidence.

Thus Oetiker argues that a holding by the Board of prima facie obviousness is a new ground of rejection, for during prosecution the examiner did not reject the claims in these words. Treating it as such, Oetiker offered affidavit evidence not [\*\*3] previously filed, and requested reconsideration on the basis of this new evidence, or remand to the examiner for this purpose, in accordance with 37 C.F.R. § 1.196(b):

§ 1.196(b) . . . When the Board . . . makes a new rejection of an appealed claim, the appellant may exercise either of the following two options . . . :

(1) The appellant may submit . . . a showing of facts . . . and have the matter reconsidered by the examiner in which event the application will be remanded to the examiner . . . .

(2) The appellant may have the case reconsidered under § 1.197(b) by the Board upon the same record.

The Board on reconsideration granted neither of the options of § 1.196(b), stating that it had not made a new rejection.

At argument before this court the Commissioner's counsel suggested that Oetiker could refile his patent application, pay a new fee, and obtain review of this new evidence in a new examination. Oetiker states that he was entitled to a complete examination, and did not get it.

#### Discussion

The prima facie case is a procedural tool of patent examination, allocating the burdens of going forward as between examiner and applicant. In re Spada, 911 F.2d 705, 707 n.3, 15 USPQ2d 1655, 1657 n.3 (Fed. Cir. 1990). [\*\*4] The term "prima facie case" refers only to the initial examination step. In re Piasecki, 745 F.2d 1468, 1472, 223 USPQ 785, 788 (Fed. Cir. 1984); In re Rinehart, 531 F.2d 1048, 1052, 189 USPQ 143, 147 (CCPA 1976). As discussed in In re Piasecki, the examiner bears the initial burden, on review of the prior art or on any other ground, of presenting a prima facie case of unpatentability. If that burden is met, the burden of coming forward with evidence or argument shifts to the applicant.

After evidence or argument is submitted by the applicant in response, patentability is determined on the totality of the record, by a preponderance of evidence with due consideration to persuasiveness of argument. See In re Spada, supra; In re Corkill, 771 F.2d 1496, 1500, 226 USPQ 1005, 1008 (Fed. Cir. 1985); In re Caveny, 761 F.2d 671, 674, 226 USPQ 1, 3 (Fed. Cir. 1985); In re Johnson, 747 F.2d 1456, 1460, 223 USPQ 1260, 1263 (Fed. Cir. 1984). [\*\*5]

If examination at the initial stage does not produce a prima facie case of unpatentability, then without more the applicant is entitled to grant of the patent. See In re Grabiak, 769 F.2d 729, 733, 226 USPQ 870, 873 (Fed. Cir. 1985); In re Rinehart, supra.

In reviewing the examiner's decision on appeal, the Board must necessarily weigh all of the evidence and argument. An observation by the Board that the examiner made a prima facie case is not improper, as long as the ultimate determination of patentability is made on the entire record. In re Piasecki, 745 F.2d at 1472, 223 USPQ at 788; In re Rinehart, 531 F.2d at 1052, 189 USPQ at 147.

The record here reveals that the application was fully prosecuted. References were cited and applied by the examiner, the applicant responded with argument, and the examiner then issued a final rejection, stating why he was not persuaded by the applicant's argument. On review the Board stated that its decision was reached "after careful consideration of the [\*\*6] appealed claims, the evidence of obviousness relied upon by the examiner and the arguments advanced by the appellant

and the examiner". The Board explained why it was unpersuaded [\*1446] by Oetiker's arguments on appeal. We discern no irregularity in the procedure. The Board, in explaining that the examiner's rejections constituted a prima facie case of obviousness, did not make a new rejection.

Oetiker also argues that the concept of a "prima facie case of obviousness" has no role outside of the chemical arts. Oetiker refers to the origins of this term in the chemical practice, where properties may not be apparent from chemical structure. Oetiker distinguishes mechanical inventions, where the properties and workings of a mechanical device are apparent in the drawing of the structure. We think that the PTO is correct in treating the concept of the prima facie case as of broad applicability, for it places the initial burden on the examiner, the appropriate procedure whatever the technological class of invention. That a prima facie case may be established, or rebutted, by different forms of evidence in various technologies does not restrict the concept to any particular field [\*\*7] of technology. "The requirement of unobviousness in the case of chemical inventions is the same as for other types of inventions". In re Johnson, 747 F.2d at 1460, 223 USPQ at 1263. This procedural tool is recognized in fields outside of the chemical arts. E.g., In re Benno, 768 F.2d 1340, 226 USPQ 683 (Fed. Cir. 1985); In re McCarthy, 763 F.2d 411, 226 USPQ 99 (Fed. Cir. 1985); In re De Blauwe, 736 F.2d 699, 222 USPQ 191 (Fed. Cir. 1984).

The Board's usage of the term prima facie was imprecise for, as discussed supra, the term "prima facie obvious" relates to the burden on the examiner at the initial stage of the examination, while the conclusion of obviousness vel non is based on the preponderance of evidence and argument in the record. However, it was clear that the Board did not make a new rejection. Therefore the Board did not err in declining to consider at that stage the proffered evidence of commercial success.

## II

### THE MERITS

Oetiker's invention is an improvement in a "stepless, [\*\*8] earless" metal clamp, a hose clamp that was generally described in an earlier '004 patent of Oetiker, but that differs in the presence of a feature that is described as a preassembly "hook". This "hook" serves both to maintain the preassembly condition of the clamp and to be disengaged automatically when the clamp is tightened.

The cited references were Oetiker's earlier-granted '004 patent, combined with a certain Lauro '400 patent. Lauro describes a plastic hook and eye fastener for use in garments, in which "unitary tabs of sewing needle punc-

turable plastic material . . . are affixable to clothing and the like by sewing". Oetiker argues that there is no suggestion or motivation to the artisan to combine the teachings of the cited references, and that Lauro is nonanalogous art. Oetiker concludes that these references were improperly combined; that a person of ordinary skill, seeking to solve the problem facing Oetiker, would not look to the garment art for the solution. Oetiker also argues that even if combined the references do not render the claimed combination obvious.

The examiner stated that "since garments commonly use hooks for securement", a person faced with the problem [\*\*9] of unreliable maintenance of the pre-assembly configuration of an assembly line metal hose clamp would look to the garment industry art. The examiner explained further by stating that "Appellant's device as disclosed could be utilized as part of a garment". The Board did not repeat or support the examiner's argument, or discuss its relevance. Indeed, the argument is not supportable. However, the Board held that the Lauro reference, although not "within the appellant's specific field of endeavor" is nonetheless "analogous art" because it relates to a hooking problem, as does Oetiker's invention.

The Board apparently reasoned that all hooking problems are analogous. At least, that is the argument now pressed by the Commissioner. The Commissioner states in his brief on appeal that "A disengageable [\*1447] catch, such as that used by Oetiker, is a common everyday mechanical concept that is variously employed in door latches and electrical and other switches, as well as in the hook and eye apparatus disclosed by Lauro". No such references were cited, however. While this court may take judicial notice of common everyday mechanical concepts in appropriate circumstances, the Commissioner did not [\*\*10] explain why a "catch" of unstated structure in an electrical switch, for example, is such a concept and would have made Oetiker's invention obvious. Indeed, the Commissioner did not respond to Oetiker's argument that the cited references provide no teaching or suggestion that Lauro's molded hook and eye fastener, even if combined with Oetiker's '004 clamp, would achieve Oetiker's purpose.

In order to rely on a reference as a basis for rejection of the applicant's invention, the reference must either be in the field of the applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the inventor was concerned. See In re Deminski, 796 F.2d 436, 442, 230 USPQ 313, 315 (Fed. Cir. 1986). Patent examination is necessarily conducted by hindsight, with complete knowledge of the applicant's invention, and the courts have recognized the subjective aspects of determining whether an inventor would reasonably be motivated to go to the field in which the examiner found the reference, in order to solve the problem con-

fronting the inventor. We have reminded ourselves and the PTO that it is necessary to consider "the [\*\*11] reality of the circumstances", In re Wood, 599 F.2d 1032, 1036, 202 USPQ 171, 174 (CCPA 1979) -- in other words, common sense -- in deciding in which fields a person of ordinary skill would reasonably be expected to look for a solution to the problem facing the inventor.

It has not been shown that a person of ordinary skill, seeking to solve a problem of fastening a hose clamp, would reasonably be expected or motivated to look to fasteners for garments. The combination of elements from nonanalogous sources, in a manner that reconstructs the applicant's invention only with the benefit of hindsight, is insufficient to present a prima facie case of obviousness. There must be some reason, suggestion, or motivation found in the prior art whereby a person of ordinary skill in the field of the invention would make the combination. That knowledge can not come from the applicant's invention itself. Diversitech Corp. v. Century Steps, Inc., 850 F.2d 675, 678-79, 7 USPQ2d 1315, 1318 (Fed. Cir. 1988); In re Geiger, 815 F.2d 686, 687, 2 USPQ2d 1276, 1278 (Fed. Cir. 1987); [\*\*12] Interconnect Planning Corp. v. Feil, 774 F.2d 1132, 1147, 227 USPQ 543, 551 (Fed. Cir. 1985).

Oetiker's invention is simple. Simplicity is not inimical to patentability. See Goodyear Tire & Rubber Co. v. Ray-O-Vac Co., 321 U.S. 275, 279, 60 USPQ 386, 388 (1944) (simplicity of itself does not negative invention); Panduit Corp. v. Dennison Mfg. Co., 810 F.2d 1561, 1572, 1 USPQ2d 1593, 1600 (Fed. Cir.) (the patent system is not foreclosed to those who make simple inventions), cert. denied, 481 U.S. 1052 (1987).

We conclude that the references on which the Board relied were improperly combined. Accordingly, the Board erred in holding the claims unpatentable under section 103. The rejection of claims 1-4 and 16-21 is

REVERSED.

CONCURBY: NIES; PLAGER

CONCUR:

NIES, Chief Judge, concurring.

I agree with the panel decision and write only to express my understanding of the language that there must be some teaching, reason, suggestion, or motivation found "in the prior art" or "in the prior art references" to make [\*\*13] a combination to render an invention obvious within the meaning of 35 U.S.C. § 103 (1988). Similar language appears in a number of opinions n1 [\*1448] and if taken literally would mean that an invention cannot be held to have been obvious unless something specific in a prior art reference would lead an inventor to

combine the teachings therein with another piece of prior art.

n1 See, e.g., Symbol Technologies, Inc. v. Opticon, Inc., 935 F.2d 1569, 1576, 19 USPQ2d 1241, 1246 (Fed. Cir. 1991); In re Gorman, 933 F.2d 982, 986, 18 USPQ2d 1885, 1888 (Fed. Cir. 1991); In re Mills, 916 F.2d 680, 682, 16 USPQ2d 1430, 1432 (Fed. Cir. 1990); Smithkline Diagnostics, Inc. v. Helena Laboratories Corp., 859 F.2d 878, 887, 8 USPQ2d 1468, 1475 (Fed. Cir. 1988); In re Dow Chemical Co., 837 F.2d 469, 473, 5 USPQ2d 1529, 1531 (Fed. Cir. 1988); In re Stencel, 828 F.2d 751, 755, 4 USPQ2d 1071, 1073 (Fed. Cir. 1987); Ashland Oil, Inc. v. Delta Resins & Refractories, Inc., 776 F.2d 281, 293, 227 USPQ 657, 664 (Fed. Cir. 1985), cert. denied, 475 U.S. 1017 (1986); In re Grabiak, 769 F.2d 729, 732, 226 USPQ 870, 872 (Fed. Cir. 1985).

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This restrictive understanding of the concept of obviousness is clearly wrong. Other statements in opinions express the idea more generally. We have stated, for example, that the test is: "whether the teachings of the prior art, taken as a whole, would have made obvious the claimed invention," In re Gorman, 933 F.2d at 986, 18 USPQ2d at 1888, and "what the combined teachings . . . would have suggested to one of ordinary skill in the art," In re Young, 927 F.2d 588, 591, 18 USPQ2d 1089, 1091 (Fed. Cir. 1991). We have also stated that "the prior art as a whole must suggest the desirability . . . of making the combination." Uniroyal, Inc. v. Rudkin-Wiley Corp., 837 F.2d 1044, 1051, 5 USPQ2d 1434, 1438 (Fed. Cir.), cert. denied, 488 U.S. 825 (1988); Lindemann Maschinfabrik GMBH v. American Hoist & Derrick Co., 730 F.2d 1452, 1462, 221 USPQ 481, 488 (Fed. Cir. 1984).

I believe that it would better reflect the concept of obviousness to speak in terms of "from the [\*\*15] prior art" rather than simply "in the prior art." The word "from" expresses the idea of the statute that we must look at the obviousness issue through the eyes of one of ordinary skill in the art and what one would be presumed to know with that background. What would be obvious to one of skill in the art is a different question from what would be obvious to a layman. An artisan is likely to extract more than a layman from reading a reference.

In any event, variance in the language used in opinions does not change the nature of the statutory inquiry. Under section 103, subject matter is unpatentable if it "would have been obvious . . . to a person having ordinary skill in the art." While there must be some teaching,

reason, suggestion, or motivation to combine existing elements to produce the claimed device, it is not necessary that the cited references or prior art specifically suggest making the combination. In re Nilssen, 851 F.2d 1401, 1403, 7 USPQ2d 1500, 1502 (Fed. Cir. 1988). Such suggestion or motivation to combine prior art teachings can derive solely from the existence of a teaching, which one of ordinary [\*\*16] skill in the art would be presumed to know, and the use of that teaching to solve the same or similar problem which it addresses. In re Wood, 599 F.2d 1032, 1037, 202 USPQ 171, 174 (CCPA 1979). See, also, EWP Corp. v. Reliance Universal, Inc., 755 F.2d 898, 906-07, 225 USPQ 20, 25 (Fed. Cir.), cert. denied, 474 U.S. 843 (1985); In re Sernaker, 702 F.2d 989, 995, 217 USPQ 1, 6 (Fed. Cir. 1983). See also, Ex parte Clapp, 227 USPQ 972, 973 (Bd. Pat. App. & Inter. 1985) ("To support the conclusion that the claimed combination is directed to obvious subject matter, either the references must expressly or implicitly suggest the claimed combination or the examiner must present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references.").

In sum, it is off the mark for litigants to argue, as many do, that an invention cannot be held to have been obvious unless a suggestion to combine prior art [\*\*17] teachings is found in a specific reference.

PLAGER, *Circuit Judge*, concurring.

I join in the carefully-reasoned and well-written opinion of Judge Newman. With regard to Part I dealing with the PTO procedure, her explanation of the meaning and application of the 'prima facie case' concept should help clarify an area that remains marked by a lack of clarity. The [\*1449] need for that discussion, however, illustrates the pitfalls of the 'prima facie' practice of the PTO, and the difficulties created by this particular legalistically convoluted concept.

An applicant for a patent is entitled to the patent unless the application fails to meet the requirements established by law. It is the Commissioner's duty (acting through the examining officials) to determine that all requirements of the Patent Act are met. The burden is on the Commissioner to establish that the applicant is not entitled under the law to a patent. In re Warner, 379 F.2d 1011, 1016, 154 USPQ 173, 177 (CCPA 1967), cert. denied 389 U.S. 1057 (1968). In rejecting an application,

factual determinations by the PTO must be based on a preponderance of [\*\*18] the evidence, and legal conclusions must be correct. In re Caveney, 761 F.2d 671, 674, 226 USPQ 1, 3 (Fed. Cir. 1985).

The process of patent examination is an interactive one. See generally, Chisum, *Patents*, § 11.03 *et seq.* (1992). The examiner cannot sit mum, leaving the applicant to shoot arrows into the dark hoping to somehow hit a secret objection harbored by the examiner. The 'prima facie case' notion, the exact origin of which appears obscure (see In re Piasecki, 745 F.2d 1468, 1472, 223 USPQ 785, 788 (Fed. Cir. 1984)), seemingly was intended to leave no doubt among examiners that they must state clearly and specifically any objections (the prima facie case) to patentability, and give the applicant fair opportunity to meet those objections with evidence and argument. To that extent the concept serves to level the playing field and reduces the likelihood of administrative arbitrariness.

But the ultimate decision that must be made by the PTO in the examination process, and by this court on appeal, is not whether a prima facie case for rejection was made; the only question is [\*\*19] whether, on the whole record, the applicant has met the statutory requirements for obtaining a patent. When a final rejection is described in terms of whether a prima facie case was made, that intermediate issue diverts attention from what should be the question to be decided.

Specifically, when obviousness is at issue, the examiner has the burden of persuasion and therefore the initial burden of production. Satisfying the burden of production, and thus initially the burden of persuasion, constitutes the so-called prima facie showing. Once that burden is met, the applicant has the burden of production to demonstrate that the examiner's preliminary determination is not correct. The examiner, and if later involved, the Board, retain the ultimate burden of persuasion on the issue.

If, as a matter of law, the issue is in equipoise, the applicant is entitled to the patent. Thus on appeal to this court as in the PTO, the applicant does not bear the ultimate burden of persuasion on the issue. In the end there is no reason there or here to argue over whether a 'prima facie' case was made out. The only determinative issue is whether the record as a whole supports the legal conclusion that [\*\*20] the invention would have been obvious.

LEXSEE

IN RE ROBERT J. GARTSIDE and RICHARD C. NORTON

99-1241

UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT

203 F.3d 1305; 2000 U.S. App. LEXIS 2065; 53 U.S.P.Q.2D (BNA) 1769

February 15, 2000, Decided

**PRIOR HISTORY:** [\*\*1] Appealed from: Patent and Trademark Office Board of Patent Appeals and Interferences. (Interference No. 103,255).

**DISPOSITION:** AFFIRMED.

**CASE SUMMARY:**

**PROCEDURAL POSTURE:** Petitioners, patent applicants, appealed from a decision of the Patent and Trademark Office Board of Patent Appeals and Interferences holding that some of their claims were unpatentable as obvious under 35 U.S.C.S. § 103.

**OVERVIEW:** Petitioners, patent applicants, appealed from a final decision of the Board of Patent Appeals and Interferences (Board) holding that some of their claims were unpatentable as obvious under 35 U.S.C.S. § 103. On appeal, the court affirmed. The court held that the Board's factual findings relating to its obviousness analysis were supported by substantial evidence, and that the Board did not err in concluding that the claims were unpatentable as obvious as a matter of law. In addition, the court found that the Board did not err in maintaining jurisdiction over the interference proceeding despite the withdrawal of a junior party, and further did not err in deciding the patentability of petitioners' claims that corresponded to the count. The court added that the Board did not abuse its discretion in resolving the patentability issues surrounding particular claims under 35 U.S.C.S. § 135(a).

**OUTCOME:** The decision of the Board of Patent Appeals and Interferences (Board) was affirmed upon finding that the Board's factual findings relating to its obviousness analysis were supported by substantial evidence, and that the Board did not err in concluding that the claims were unpatentable as obvious as a matter of law.

**CORE TERMS:** patent, patentability, substantial evidence, cracking, catalytic, unpatentable, factfinding, capricious, invention, corresponding, combine, motivation, undesired, quench, declaration, examiner, oil, fully developed, subject matter, sua sponte, withdrawal, teaching, teach, solids, public interest, solved, quenching, feed, obviousness, deferential

**COUNSEL:** Alan B. Clement, Heidman, Gibson & Costigan, of New York, New York, argued for appellants.

Mark Nagumo, Associate Solicitor, Office of the Solicitor, of Arlington, Virginia, argued for appellee. With him on the brief were Albin F. Drost, Acting Solicitor; John M. Whealan, Acting Deputy Solicitor; and Nancy Moncys Isacson, Associate Solicitor.

**JUDGES:** Before LOURIE, CLEVINGER, and RADER, Circuit Judges.

**OPINIONBY:** LOURIE

**OPINION:** [\*1308]

LOURIE, Circuit Judge.

Robert J. Gartside and Richard C. Norton (collectively "Gartside") appeal from the final decision of the Board of Patent Appeals and Interferences holding that claims 34, 35, and 37-47 of application Ser. No. 07/798,627 are unpatentable as obvious under 35 U.S.C. § 103. See *Forgac v. Gartside*, Paper No. 72 (BPAI May 21, 1998). Because the Board's factual findings relating

to its obviousness analysis are supported by substantial evidence, and because the Board did not err in concluding that the claims were unpatentable as obvious as a matter of law, we affirm.

#### BACKGROUND

##### A. [\*\*2] The Invention

Gartside's application is directed to "cracking" processes, i.e., processes that generate low molecular weight, purified hydrocarbons of desired molecular composition by breaking down impure, high molecular weight hydrocarbon feed oil. Cracking is accomplished by reacting impure feed oil with "solids," particulate matter that induces the breakdown of feed oil by either a thermal or catalytic reaction mechanism. See '627 application, J.A. at 63. The claims at issue are all directed to catalytic cracking processes. Independent claim 47 has been argued to us as being "representative" of claims 34, 35, 37-40, and 42-44 and reads as follows:

47. A catalytic process comprising the steps of:

catalytically cracking hydrocarbon feed oil in a reactor of a catalytic cracking unit in the presence of a cracking catalyst at a temperature ranging from 1100 to 1500 degrees F to produce a catalytically cracked effluent stream of upgraded oil containing catalyst;

substantially separating said catalyst from said upgraded oil in a separator and a cyclone; and

quenching said upgraded oil downstream of said separator upstream of said cyclone with a quenching [\*\*3] oil.

Id. at 51 (paragraphing added). Independent claim 41 is similarly "representative" of dependent claims 45 and 46 and reads as follows:

41. A catalytic process, comprising the steps of:

(a) delivering hot particulate catalytic cracking solids to a catalytic cracking reactor;

(b) delivering a hydrocarbon feed to said reactors;

(c) cracking said hydrocarbon feed in said reactor at a temperature of from 1100 to 1500 degrees F to produce a cracked product;

(d) separating said catalytic solids from the cracked product;

(e) quenching said cracked product;

wherein the total residence time from step (a) through step (e) ranges from 0.1 to 0.6 seconds.

Id. at 49 (paragraphing added).

##### B. The Interference Proceeding

Gartside copied claims from Forgac's U.S. Patent 5,043,058, entitled "Quenching Downstream of an External Vapor Catalyst Separator," into the '627 application, attempting to provoke an interference. n1 On February 4, 1994, the Administrative Patent Judge ("APJ") declared the interference [\*1309] between Gartside's application and Forgac's patent. See Paper No. 17 at 1. The APJ designated Gartside as the "senior [\*\*4] party" and Forgac as the "junior party" in the interference, because Gartside's application was accorded an effective filing date prior to March 26, 1990, the filing date of the application that issued as Forgac's patent. See id. at 2-3. The APJ also determined that one count encompassed all of the interfering subject matter, n2 i.e., claims 34-47 of the application and claims 1, 2, and 13 of the patent, and that that count corresponded exactly to claim 47 of the application. See id. at 3-4.

n1 37 C.F.R. § 1.601(i) defines an "interference" in relevant part as follows:

An interference is a proceeding instituted in the Patent and Trademark Office before the Board to determine any question of patentability and priority of invention between two or more parties claiming the same patentable invention. . . . An interference may be declared between one or more pending applications and one or more unexpired patents naming

different inventors when, in the opinion of an examiner, any application and any unexpired patent contain claims for the same patentable invention.

37 C.F.R. § 1.601(i) (1999).

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n2 37 C.F.R. § 1.601(f) defines "count" as follows:

A count defines the interfering subject matter between two or more applications or between one or more applications and one or more patents. At the time the interference is initially declared, a count should be broad enough to encompass all of the claims that are patentable over the prior art and designated to correspond to the count.

37 C.F.R. § 1.601(f) (1999).

On September 12, 1995, the APJ issued an order addressing the parties' motions filed during the preliminary motion period. See Paper No. 41 at 1-2. Of the parties' eight motions, only two are relevant here: Gartside's motion to designate certain claims as not corresponding to the count, and Forgac's motion for judgment that all of Gartside's claims were unpatentable under 35 U.S.C. § 103. The APJ denied Gartside's motion to designate claims 36, 41, 45, and 46 as not corresponding to the count, concluding that Gartside had failed to show that those claims were patentably distinct from the other claims corresponding to the count. See generally [\*\*6] id. at 7-11. The APJ granted in part Forgac's motion for judgment that Gartside's claims were invalid under § 103. See id. at 11. The APJ first observed that while Forgac's motion was directed to all of Gartside's claims corresponding to the count (claims 34-47), Forgac only performed a § 103 analysis as to claim 47. See id. at 11-12. The APJ apparently concluded that this analysis was acceptable with regard to the claims for which Gartside had not presented specific patentability arguments, namely claims 34, 35, 37-40, and 42-44, and indicated that those claims would thus stand or fall based on the arguments made on behalf of claim 47. See id. at 12.

Since Gartside argued separately the patentability of claims 36, 41, 45, and 46, the APJ indicated that those claims would be considered apart from claim 47. See id.

Analyzing the claims that stood or fell with claim 47 first, the APJ held that those claims were unpatentable as obvious under § 103. See id. at 12. The APJ based his conclusion on Gartside's U.S. Patent 4,552,645, which teaches a process of thermally cracking feed oil that is nearly identical to the process claimed in claim 47, either alone or in [\*\*7] combination with Gartside's U.S. Patent 4,288,235, which discloses apparatus that may be used for both thermal and catalytic processes employing low residence times and quenching to prevent undesired cracking. See id. The APJ found that the motivation to combine the thermal cracking teachings of the '645 patent with a catalytic cracking process as disclosed in the '235 patent arose from the nature of the problem to be solved, viz., undesired cracking due to the presence of thermal or catalytic solids. See id. at 15. Thus, the APJ concluded that claim 47, as well as claims 34, 35, 37-40, and 42-44, were unpatentable under § 103. See id. at 12. [\*1310]

Having previously concluded that claims 36, 41, 45, and 46 did not stand or fall with claim 47, the APJ proceeded to analyze those claims as if Forgac had not placed their patentability at issue. The APJ held, sua sponte, that claims 36, 41, 45, and 46 were unpatentable under § 103, based on the '645 patent in view of U.S. Patent 4,419,221 (Castagnos), or on those two patents in view of the '235 patent, incorporating his reasoning with respect to claims 34, 35, 37-40, 42-44, and 47. See id. at 18-19. As noted above, [\*\*8] essentially all of the limitations of claims 34, 35, 37-40, 42-44, and 47 were found in the combination of the '645 patent with the '235 patent. Since claims 36, 41, 45, and 46 each contain all of those limitations, as well as an additional kinetic residence time limitation, the APJ needed to add one additional reference to complete the combination. Accordingly, the APJ added Castagnos to the '645 and '235 patent combination, as Castagnos discloses the precise kinetic residence time recited in claims 36, 41, 45, and 46. See id. at 19-20. The APJ again found that the motivation to combine the teachings of the patents arose from the nature of the problem to be solved, i.e., optimizing yields by avoiding undesired cracking. See id. at 20. n3

n3 Although not appealed here, the APJ also concluded that claims 1, 2, and 13 of Forgac's '058 patent were all unpatentable under § 103 based on the '645 patent and U.S. Patent 4,764,268, or over those two references in combination with the '235 patent. See id. at 21.



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Gartside requested reconsideration of the denial of his motion to redesignate claims 36, 41, 45, and 46 as not corresponding to the count, see Paper No. 45, and the granting in part of Forgac's motion to hold Gartside's claims unpatentable under § 103, see Paper No. 43. On reconsideration, the APJ denied both of these requests. See Paper No. 49. As for the sua sponte holdings of unpatentability, Forgac and Gartside each filed timely responses, neither of which persuaded the examiner to depart from his earlier holdings, see Paper No. 50 at 15. n4 The APJ then ordered the parties to show cause why judgment should not be entered against them with respect to the patentability of all the claims corresponding to the count. See id. In response, Forgac and Gartside each requested a final hearing before the Board. See Paper Nos. 51 and 54.

n4 The APJ noted that in his response, Gartside had not contested the APJ's sua sponte holding that claim 36 was unpatentable (Paper No. 47), see Paper No. 50 at 14, and the APJ thus rendered judgment accordingly. Likewise, the Board did not address this claim in its final decision, see Paper No. 72 at 10 n.10, and Gartside does not argue the patentability of claim 36 on appeal.

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On May 20, 1996, Forgac withdrew his request for a final hearing and authorized the APJ to cancel claims 1, 2, and 13 from the '058 patent. See Paper No. 63 at 1-2. Despite Forgac's withdrawal from the interference, the APJ held that the interference should proceed based on our decision in Perkins v. Kwon, 886 F.2d 325, 12 U.S.P.Q.2D (BNA) 1308 (Fed. Cir. 1989), as the issues surrounding the patentability of Gartside's claims had been fairly placed at issue and fully developed during the interference, and they therefore should be resolved for the sake of the public interest. See Paper No. 64 at 3-5. Gartside requested reconsideration of this order and asked that his application be remanded to the primary examiner for further prosecution. See Paper No. 65 at 1. The APJ dismissed both requests, see Paper No. 66, and a final hearing was held on May 21, 1998.

The Board first held that the APJ properly concluded that the Board retained jurisdiction over the patentability issues raised in the interference. See Gartside, Paper No. 72 at 9. The Board reasoned that under our decision in Schulze v. Green, 136 F.3d 786, 45 U.S.P.Q.2D (BNA) 1769 (Fed. Cir. 1998), [\*\*11] the Board should decide [\*\*1311] the patentability issues despite Forgac's withdrawal, as those issues were fairly raised and fully de-

veloped in the course of the interference. See id. at 7-9. The Board also noted that Gartside was not procedurally disadvantaged by the Board's decision to retain jurisdiction rather than remand to the examiner. See id. at 6-7.

Turning to the merits, the Board concluded that the APJ did not abuse his discretion n5 in holding that claims 34, 35, 37-40, 42-44 and 47 of the '627 application were unpatentable under § 103. See id. at 19. The Board agreed with the APJ that those claims would have been obvious based on the '645 patent alone or in combination with the '235 patent. See id. at 19. The Board also agreed with the APJ that the motivation to combine those references arose from the nature of the problem to be solved, viz., minimizing undesired cracking. See id. at 15.

n5 37 C.F.R. § 1.655(a) sets forth the Board's standard of review with respect to interlocutory orders entered by the APJ:

The Board may also consider whether entry of any interlocutory order was an abuse of discretion. All interlocutory orders shall be presumed to have been correct, and the burden of showing an abuse of discretion shall be on the party attacking the order.

37 C.F.R. § 1.655(a) (1999).

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As for claims 41, 45, and 46, the Board first held that the APJ did not abuse his discretion in denying Gartside's motion to redesignate those claims as not corresponding to the count, reasoning that Gartside had failed to show that those claims were patentably distinct from the other claims corresponding to the count. See id. at 21-22, 27. The Board further held that the APJ did not abuse his discretion in holding sua sponte that those claims were unpatentable under § 103 based on the combination of the '645 patent and the Castagnos patent, or those two patents in view of the '235 patent, see id. at 28-29, and that a motivation to combine them arose from the nature of the problem to be solved (minimizing undesired cracking) and from the references themselves, see id. at 25-27. The Board also found that Gartside's evidence of unexpected results in the form of the "second Johnson declaration" was unpersuasive, as that evidence did not pertain to the same process as that of the claims at issue. See id. at 35-36.

## DISCUSSION

### A. Standards of Review

#### 1. Review of Factfinding by the Board of Patent Appeals and Interferences

In Dickinson v. Zurko, 527 U.S. 150, 119 S. Ct. 1816, 50 U.S.P.Q.2D (BNA) 1930, 144 L. Ed. 2d 143 (1999), [\*13] the Supreme Court reversed our en banc decision that held that the appropriate standard of review of PTO findings of fact is the clearly erroneous standard, see Dickinson v. Zurko, 142 F.3d 1447, 1449, 46 U.S.P.Q.2D (BNA) 1691, 1693 (Fed. Cir. 1998), and held that we must apply one of the standards set forth in the Administrative Procedure Act ("APA") at 5 U.S.C. § 706 (1994), see Zurko, 119 S. Ct. at 1818, 50 U.S.P.Q.2D (BNA) at 1931-32.

Section 706 reads in relevant part as follows:

#### § 706. Scope of Review

The reviewing court shall--

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(2) hold unlawful and set aside agency action, findings, and conclusions found to be--

(A) arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law;

\*\*\*

(E) unsupported by substantial evidence in a case subject to sections 556 and 557 of this title or otherwise reviewed on the record of an [\*1312] agency hearing provided by statute . . . .

5 U.S.C. § 706(2)(A), (E) (1994). In Zurko, the Supreme Court did not determine whether the correct standard of review for PTO findings of fact is the "arbitrary, capricious" or [\*14] the "substantial evidence" test. See Zurko, 119 S. Ct. at 1821, 50 U.S.P.Q.2D (BNA) at 1934. We feel compelled to decide that question, in order to secure the standard of review through which we will test the decision of the Board in this case.

The Supreme Court has indicated that the "arbitrary, capricious" standard of review is highly deferential. Under that standard, a reviewing court "must consider whether

the decision was based on a consideration of relevant factors and whether there has been a clear error of judgment." Citizens to Preserve Overton Park, Inc. v. Volpe, 401 U.S. 402, 416, 28 L. Ed. 2d 136, 91 S. Ct. 814 (1971). Because this standard is generally considered to be the most deferential of the APA standards of review, see e.g., 6 Stein et al., Administrative Law § 51.03, at 51-117 (1999) ("The narrowest scope of judicial review of an agency['s] fact findings is afforded by the arbitrary, capricious, or abuse of discretion test."), the reviewing court analyzes only whether a rational connection exists between the agency's factfindings and its ultimate action, see Hyundai Elecs. Indus. Co. v. ITC, 899 F.2d 1204, 1209, 14 U.S.P.Q.2D (BNA) 1396, 1400 (Fed. Cir. 1990) [\*15] (noting that the "touchstone" of the "arbitrary, capricious" standard is rationality); see also 6 Administrative Law § 51.03, at 51-128.

On the other hand, the "substantial evidence" standard asks whether a reasonable fact finder could have arrived at the agency's decision, see Consolidated Edison Co. v. NLRB, 305 U.S. 197, 229, 83 L. Ed. 126, 59 S. Ct. 206 (1938); see generally 3 Charles H. Koch, Jr., Administrative Law and Practice § 10.3[1], at 22-26 (2d ed. 1997), and is considered to be a less deferential review standard than "arbitrary, capricious." See American Paper Inst., Inc. v. American Elec. Power Serv. Corp., 461 U.S. 402, 412-13 n.7, 76 L. Ed. 2d 22, 103 S. Ct. 1921 (1983) (characterizing the "arbitrary, capricious" standard as "more lenient" than the "substantial evidence" standard); Abbott Lab. v. Gardner, 387 U.S. 136, 143, 18 L. Ed. 2d 681, 87 S. Ct. 1507 (1967) (characterizing "substantial evidence" review as "more generous judicial review" than "arbitrary, capricious" review). The Supreme Court has described "substantial evidence" in the following manner:

Substantial evidence is more [\*16] than a mere scintilla. It means such relevant evidence as a reasonable mind might accept as adequate to support a conclusion. . . . Mere uncorroborated hearsay or rumor does not constitute substantial evidence.

Consolidated, 305 U.S. at 229-30 (citations omitted); see also AK Steel Corp. v. United States, 192 F.3d 1367, 1371 (Fed. Cir. 1999) (quoting Consolidated). The Court has emphasized that "substantial evidence" review involves examination of the record as a whole, taking into account evidence that both justifies and detracts from an agency's decision. See Universal Camera Corp. v. NLRB, 340 U.S. 474, 487-88, 95 L. Ed. 456, 71 S. Ct. 456 (1951). The Court has also stated, however, that "the

possibility of drawing two inconsistent conclusions from the evidence does not prevent an administrative agency's finding from being supported by substantial evidence." See Consolo v. Federal Maritime Comm'n, 383 U.S. 607, 620, 16 L. Ed. 2d 131, 86 S. Ct. 1018 (1966).

Moreover, courts have recognized that the "arbitrary, capricious" standard is one of default. See Association of Data Processing Serv. Orgs., Inc. v. Board of Governors of Fed. Reserve Sys., 240 U.S. App. D.C. 301, 745 F.2d 677, 683 [\*1313] (D.C. Cir. 1984) [\*\*17] (the "arbitrary, capricious" standard "is a catch-all, picking up administrative misconduct not covered by the other more specific paragraphs."); see also Olenhouse v. Commodity Credit Corp., 42 F.3d 1560, 1575 n.25 (10th Cir. 1994). In other words, the "arbitrary, capricious" standard applies when the "substantial evidence" test of section 706(2)(E) is deemed inapplicable. See Aircraft Owners & Pilots Ass'n v. FAA, 195 U.S. App. D.C. 151, 600 F.2d 965, 969 (D.C. Cir. 1979). Thus, we return to the statute.

Section 706(2)(E) provides that "substantial evidence" review is afforded to agency factfinding performed during an adjudication in two circumstances: (1) factfinding performed in "a case subject to sections 556 and 557 of this title," and (2) factfinding performed in a case "reviewed on the record of an agency hearing provided by statute." 5 U.S.C. § 706(2)(E). Factfinding by the Board does not fall within the first category, as § 554 excludes PTO adjudication from the trial-type procedures set forth in 5 U.S.C. §§ 556 and 557. Specifically, section § 554(a)(1) excludes agency adjudication from these requirements when the subject [\*\*18] matter of that adjudication is subject to a subsequent trial de novo, see 5 U.S.C. § 554(a)(1) (1994), n6 as in the case of Board adjudication, see 35 U.S.C. § 145 (1994) ("Civil action to obtain a patent"); id. § 146 (1994) ("Civil action in case of interference"). Accordingly, these interrelated statutes dictate that Board factfinding does not fall within the first category of § 706(2)(E).

n6 Section 554(a)(1) provides that:

(a) This section applies, according to the provisions thereof, in every case of adjudication by statute to be determined on the record after opportunity for an agency hearing, except to the extent that there is involved--

(1) a matter subject to a subsequent trial of the law and the facts de novo in a court . . . .

5 U.S.C. § 554(a)(1) (1994) (emphasis added).

We next consider whether our review of Board factfindings made in the course of its adjudicatory proceedings falls within [\*\*19] the second category of § 706(2)(E), i.e., "or otherwise reviewed on the record of an agency hearing provided by statute." 5 U.S.C. § 706(2)(E). Section 144 explicitly provides that we must review Board decisions "on the record" developed by the PTO, see 35 U.S.C. § 144 (1994) ("The United States Court of Appeals for the Federal Circuit shall review the decision from which an appeal is taken on the record before the Patent and Trademark Office.") (emphasis added), and it is for this reason that the Commissioner is required to convey the record to us in the event of an appeal, see id. § 143. Moreover, the "hearing" upon which the "record" is based is "provided by" 35 U.S.C. § 7(b), which states that:

The Board of Patent Appeals and Interferences shall, on written appeal of an applicant, review adverse decisions of examiners upon applications for patents and shall determine priority and patentability of invention in interferences declared under section 135(a) of this title. Each appeal and interference shall be heard by at least three members of the Board of Patent Appeals and Interferences, [\*\*20] who shall be designated by the Commissioner. Only the Board of Patent Appeals and Interferences has the authority to grant rehearings.

35 U.S.C. § 7(b) (1994) (emphasis added). Thus, the plain language of §§ 7 and 144 of Title 35 indicates that we review Board decisions "on the record of an agency hearing provided by statute," and that we should therefore review Board factfinding for "substantial evidence." See also Thomas Leonard Stoll, A Clearly Erroneous Standard of Review, 79 J. Pat. & [\*1314] Trademark Off. Soc'y 100, 106 (1997) (arguing in favor of "substantial evidence" review based on 35 U.S.C. §§ 7(b) and 144).

In appeals from the Board, we have before us a comprehensive record that contains the arguments and evidence presented by the parties, including all of the

relevant information upon which the Board relied in rendering its decision. See 35 U.S.C. § 143 (1994) ("The Commissioner shall transmit to the United States Court of Appeals for the Federal Circuit a certified list of the documents comprising the record in the Patent and Trademark Office."). That record, when before us, is closed, in **[\*\*21]** that the Board's decision must be justified within the four corners of that record. The record before us on appeal thus dictates the parameters of our review. We cannot look elsewhere to find justification for the Board's decision. Furthermore, the record reflects the results of a proceeding in the PTO during which the applicant has been afforded an opportunity to bring forth the facts thought necessary to support his or her position. Accompanying the record is a detailed opinion from the Board. We have expressly held that the Board's opinion must explicate its factual conclusions, enabling us to verify readily whether those conclusions are indeed supported by "substantial evidence" contained within the record. See Gechter v. Davidson, 116 F.3d 1454, 1460, 43 U.S.P.Q.2D (BNA) 1030, 1035 (Fed. Cir. 1997) ("We hold that the Board is required to set forth in its opinions specific findings of fact and conclusions of law adequate to form a basis for our review.").

In addition to the statutory language discussed above, Supreme Court precedent and the law of our sister circuits also indicate that "substantial evidence" review is appropriate in view of the plenary nature of the record **[\*\*22]** before us. The Supreme Court has stated generally that the "basic requirement" for "substantial evidence" review is that the agency hearing produce a record that serves as the foundation for the agency's action. See Overton Park, 401 U.S. at 415; Camp v. Pitts, 411 U.S. 138, 141, 36 L. Ed. 2d 106, 93 S. Ct. 1241 (1973) (noting that "substantial evidence" review "is appropriate when reviewing findings made on a hearing record"). In Zurko the Court echoed these prior decisions when it intimated that "substantial evidence" review is the appropriate standard for our review of Board factfinding. See Zurko, 119 S. Ct. at 1823, 50 U.S.P.Q.2D (BNA) at 1936 ("A reviewing court reviews an agency's reasoning to determine whether it is 'arbitrary' or 'capricious,' or, if bound up with a record-based factual conclusion, to determine whether it is supported by 'substantial evidence.'").

Chrysler Corp. v. DOT, 472 F.2d 659 (6th Cir. 1972), is instructive. In that case, the court had to determine whether the "arbitrary, capricious" or the "substantial evidence" test should be applied to automobile safety standards promulgated by the Secretary **[\*\*23]** of Transportation. Those standards emerged from a statutorily mandated agency rulemaking hearing that was not "formal" in the sense of cases subject to sections 556 and 557 of the APA. The agency argued that the appropriate

standard of review was the most deferential "arbitrary, capricious" standard, because the promulgated safety standards emerged not from formal adjudication, but from informal rulemaking. See id. at 667. To the contrary, the industry petitioners argued that the default standard should not apply, because the safety standards arose from hearings compelled by statute, and the scope of appellate review was confined to the record made before the agency in the informal rulemaking process. See id. The court concluded that the "substantial evidence" test of section 706(2)(E) should apply because the agency was required by law to compile a record that would restrict the scope of appellate review. See id. at **[\*1315]** 668. Consequently, only the evidence in the record could be used by the appellate court to justify or refute the agency action. In contrast, the court noted that when an agency decision is made on "the basis of data contained in its **[\*\*24]** own files or on its own views or opinions . . . a reviewing court cannot test the rules as promulgated against the evidence in the agency's record." Id. at 669. In those circumstances, the more deferential standard of review would be appropriate. n7

n7 We recognize that a distinction has been drawn between formal and informal proceedings to determine which APA standard to apply, with the most deferential standard thought to be applicable in reviewing agency decisions made in informal settings. See 6 Administrative Law § 51.01[2], at 51-48. This distinction alone, however, cannot dispositively answer the standard of review question when an agency hearing is compelled by a law that also requires a closed record to be made of the proceeding, and Congress has limited the scope of appellate review to the record made of the agency's deliberations.

The reasoning of the D.C. Circuit also supports our conclusion that "substantial evidence" review applies when the reviewing court must confine **[\*\*25]** its review of agency factfinding to the record produced by the agency proceeding. In Data Processing, the D.C. Circuit considered the APA standards of review, and concluded that "the distinctive function of paragraph (E)--what it achieves that paragraph (A) does not--is to require substantial evidence to be found within the record of closed-record proceedings to which it exclusively applies." Data Processing, 745 F.2d at 684 (emphasis added); see also id. at 683 ("The ['substantial evidence' test] is only a specific application of the ['arbitrary, capricious' test], separately recited in the APA . . . to emphasize that in the case of [section 706(2)(E)] proceedings the factual support must be found in the closed record as opposed to elsewhere.").

Because our review of the Board's decision is confined to the factual record compiled by the Board, we accordingly conclude that the "substantial evidence" standard is appropriate for our review of Board factfindings. See 5 U.S.C. § 706(2)(E).

## 2. Other Applicable Standards of Review

Whether the Board possessed jurisdiction to continue the interference in order to decide the [\*\*26] patentability of Gartside's claims is a question of law that we review de novo. See James M. Ellett Constr. Co. v. United States, 93 F.3d 1537, 1541 (Fed. Cir. 1996) ("Jurisdiction is a question of law [that] . . . we review de novo."). We review for an abuse of discretion the Board's decision to resolve issues of patentability that were not placed in issue by the parties during the interference. See 5 U.S.C. § 135(a) (providing that the Board "may determine questions of patentability" during the course of an interference) (emphasis added); 37 C.F.R. § 1.641(a) (1999); n8 Perkins, 886 F.2d at 328, 12 U.S.P.Q.2D (BNA) at 1311 ("The word 'may' in § 135(a) accommodates the situation when patentability is not placed at issue during the priority contest, but it would contradict the remedial purpose of the legislation if the Board could refuse to decide questions of patentability for which there had been adduced an appropriate record."). An abuse of discretion occurs when a decision is based on an erroneous [\*\*1316] interpretation of law or clearly erroneous factfinding, or if that "decision represents an unreasonable judgment in weighing [\*\*27] relevant factors." A.C. Aukerman Co. v. R.L. Chaides Constr. Co., 960 F.2d 1020, 1039, 22 U.S.P.Q.2D (BNA) 1321, 1333 (Fed. Cir. 1992) (en banc). In view of our holding that we review Board factfinding for substantial evidence, we will modify the second criterion accordingly.

n8 Section 1.641(a) provides that:

During the pendency of the interference, if the administrative patent judge becomes aware of a reason why a claim designated to correspond to a count may not be patentable, the administrative patent judge may enter an order notifying the parties of the reason and set a time within which each party may present its views, including any argument and any supporting evidence, and, in the case of the party whose claim may be unpatentable, any appropriate preliminary mo-

tions under § § 1.633 (c), (d) and (h).

37 C.F.R. § 1.641(a) (1999) (emphasis added).

Whether a claimed invention is unpatentable as obvious under § 103 is a question of law based on underlying findings of fact. [\*\*28] See In re Dembiczak, 175 F.3d 994, 998, 50 U.S.P.Q.2D (BNA) 1614, 1616 (Fed. Cir. 1999) (citing Graham v. John Deere Co., 383 U.S. 1, 17-18, 148 U.S.P.Q. (BNA) 459, 467, 15 L. Ed. 2d 545, 86 S. Ct. 684 (1966)). The presence or absence of a motivation to combine references in an obviousness determination is a pure question of fact. See *id.* at 1000, 50 U.S.P.Q.2D (BNA) at 1617. The Board's legal conclusion of obviousness is reviewed de novo. See In re Rouffet, 149 F.3d 1350, 1355, 47 U.S.P.Q.2D (BNA) 1453, 1455 (Fed. Cir. 1998); see also 5 U.S.C. § 706 (1994) ("To the extent necessary to decision and when presented, the reviewing court shall decide all relevant questions of law. . . ."). Although we have previously reviewed the Board's factual determinations in an obviousness analysis for clear error, see Dembiczak, 175 F.3d at 998, 50 U.S.P.Q.2D (BNA) at 1616; Kemps, 97 F.3d 1427 at 1429-30, 40 U.S.P.Q.2D (BNA) 1309 at 1311-12, we now review them for substantial evidence.

## B. Jurisdiction

Gartside argues that the Board erred in retaining jurisdiction over the interference proceeding, as no interfering subject matter remained after [\*\*29] Forgac's withdrawal from the interference. Gartside thus contends that the interference should have been dissolved and that the patentability issues should have been decided by the examiner ex parte. Gartside further asserts that the Board abused its discretion in addressing those issues, as the public interest relied on in Perkins v. Kwon was not here implicated, and the denial of remand to the examiner deprived him of certain procedural safeguards, e.g., the right to amend, refile as a continuation application, and present evidence of unexpected results.

Citing Guinn v. Kopf, 96 F.3d 1419, 40 U.S.P.Q.2D (BNA) 1157 (Fed. Cir. 1996), the Commissioner responds that Forgac's withdrawal did not divest the Board of jurisdiction to decide the patentability issues developed during the interference, and that under Perkins, the Board must decide all issues fairly raised and fully developed during the interference. The Commissioner further contends that the Board did not abuse its discretion in deciding the patentability of Gartside's claims because the public interest in Perkins was implicated and Gartside was denied no procedural safeguards, as Gartside's

procedural [\*\*30] options in the interference paralleled his options in ex parte examination.

Section 135(a) sets forth the Commissioner's authority to declare interference proceedings and the Board's jurisdiction to resolve issues relating to priority and patentability that arise during such proceedings. Section 135(a) provides in relevant part that:

(a) Whenever an application is made for a patent which, in the opinion of the Commissioner, would interfere with any pending application, or with any unexpired patent, an interference may be declared and the Commissioner shall give notice of such declaration to the applicants, or the applicant and patentee, as the case may be. The Board of Patent Appeals and Interferences shall determine questions of priority of the inventions and may determine questions of patentability.

35 U.S.C. § 135(a) (1994) (emphasis added). In *Perkins*, we held that under [\*1317] § 135(a), the Board should decide issues relating to priority and patentability that are fairly raised and fully developed during the interference, despite the permissive language of § 135(a) with respect to patentability issues. See *Perkins*, 886 F.2d at 328-29, 12 U.S.P.Q.2D (BNA) at 1310-11; [\*\*31] see also *Schulze*, 136 F.3d at 792, 45 U.S.P.Q.2D (BNA) at 1774-75; *Wu v. Wang*, 129 F.3d 1237, 1242, 44 U.S.P.Q.2D (BNA) 1641, 1645 (Fed. Cir. 1997). We noted that the permissive language addresses "the situation when patentability is not placed at issue during the priority contest, but it would contradict the remedial purpose of the legislation if the Board could refuse to decide questions of patentability for which there had been adduced an appropriate record." See *Perkins*, 886 F.2d at 328, 12 U.S.P.Q.2D (BNA) at 1311.

In *Guinn* we extended *Perkins*, holding that even when a party attempts to terminate the interference by disclaiming all of its claims relating to the count, the Board should decide priority when priority issues have been fairly raised and fully developed at the Board. See *Guinn*, 96 F.3d at 1421-22, 40 U.S.P.Q.2D (BNA) at 1159. In that case, *Guinn* attempted to terminate the interference by disclaiming his one claim that corresponded to the count, see 35 U.S.C. § 253 (1994), and moving to dismiss for lack of jurisdiction on the basis of a lack of controversy. See *Guinn*, 96 F.3d at 1420, 40 U.S.P.Q.2D (BNA) at 1158. [\*\*32] *Guinn* argued that absent a priority dispute, the Board lacked jurisdiction to enter judgment against him in the interference pursuant

to 37 C.F.R. § 1.662. See *id.* Rather than dismiss, however, the Board entered judgment against *Guinn*. See *id.*

*Guinn* appealed and we affirmed, holding that the disclaimer of all the claims corresponding to a count did not divest the Board of jurisdiction over the interference. See *id.* at 1421-22, 40 U.S.P.Q.2D (BNA) at 1159. We reasoned that once an interference has been properly declared, § 135(a) directs that the Board "shall determine questions of priority," and that under *Perkins*, the Board should resolve priority issues that have been fully developed before the Board. See *id.*

Based on *Perkins* and *Guinn*, we agree with the Commissioner that *Forgac's* withdrawal did not divest the Board of jurisdiction over the interference, and that the Board did not abuse its discretion in deciding the patentability of *Gartside's* claims. Even though *Guinn* involved a remaining issue of priority rather than patentability, we agree with the Commissioner that *Guinn* is sufficiently on point. In *Forgac's* notice to withdraw his request [\*\*33] for a final hearing, *Forgac* authorized the APJ to cancel claims 1, 2, and 13 from the '058 patent, see Paper No. 63 at 2, the functional equivalent of *Guinn* disclaiming his claims corresponding to the count under § 253. Likewise, neither party here disputes that the interference was properly declared. While part of our reasoning in *Guinn* hinged on the fact that § 135(a) mandates that the Board "shall determine questions of priority," in *Perkins* we interpreted the language "may determine issues of patentability" as nearly mandatory when those issues have been fairly raised and fully developed before the Board. See *Perkins*, 886 F.2d at 328-29, 12 U.S.P.Q.2D (BNA) at 1310-11. Moreover, as with the priority issues in *Guinn*, the issues surrounding the patentability of *Gartside's* claims were fairly raised and fully developed during the proceeding. n9 Accordingly, we conclude that the Board properly resolved these issues under § 135(a).

n9 Prior to *Forgac's* withdrawal, *Forgac* raised the issue of the patentability of all of *Gartside's* claims in a preliminary motion to the APJ, *Gartside* opposed that motion, and *Forgac* in turn replied to that opposition. See Papers No. 20, 29, and 36. Following the APJ's granting-in-part of *Gartside's* motion, *Gartside* further developed this issue in his request for reconsideration. See Papers No. 41 and 43. Moreover, the APJ independently raised and developed the issue of the patentability of claims 41, 45, and 46 in his sua sponte holding of unpatentability, to which *Gartside* also responded. See Papers No. 41 and 47. Even after *Forgac's* withdrawal, *Gartside* was provided with additional opportunities to develop

the patentability issues before the Board. See Gartside's BPAI Br. at 4-24, 27-30.

[\*\*34] [\*1318]

As we noted *supra*, the APJ raised the issue of the patentability of claims 41, 45, and 46 *sua sponte*. To the extent that the *sua sponte* holding meant that Forgac did not properly place the patentability of these claims at issue before the Board, we agree with the Commissioner that the Board acted within its discretion to decide the patentability of those claims based on the public interest as noted in Perkins and the fact that Gartside was in no way prejudiced by resolution of those issues by the Board rather than the examiner.

First, the public interest as discussed in Perkins is clearly served by the Board's resolution of the patentability issues surrounding Gartside's claims. The Board had already addressed the patentability issues with respect to claims 34, 35, 37-40, and 42-44, and the validity of claims 41, 45, and 46 turned on two of the same references used to invalidate those other claims. By deciding the patentability of claims 41, 45, and 46, the Board avoided yet another round of duplicative arguments before the examiner and achieved a timely resolution to the benefit of the parties and the public in general. As we stated in Perkins:

The [\*\*35] Board, by resolving both priority and patentability when these questions are fully presented, settles not only the rights between the parties but also rights of concern to the public. The public interest in the benefits of a patent system is best met by procedures that resolve administratively questions affecting patent validity that arise before the PTO. To do otherwise is contrary to the PTO's mission to grant presumptively valid patents, 35 U.S.C. § 282, and thus disserves the public interest.

Perkins, 886 F.2d at 328-29, 12 U.S.P.Q.2D (BNA) at 1311.

Moreover, we agree with the Commissioner that Gartside was not denied any procedural safeguards by the Board's refusal to remand to the examiner. Gartside was afforded the opportunity to redefine the interfering subject matter by amending his claims, see 37 C.F.R. § 1.633(c)(2) (1999), and he was free to file a continuation application, see 37 C.F.R. § 1.633(d) (1999); see also 35 U.S.C. § 120 (1994). Moreover, 37 C.F.R. § 1.639 per-

mits a party to introduce evidence in support of motions, oppositions, and replies, and 37 C.F.R. § 1.640(e)(3) also enables a [\*\*36] party to introduce evidence in response to an order to show cause. Although Gartside alleges that he was prejudiced for want of other assorted procedural safeguards, these allegations are similarly without merit.

In sum, we conclude that the Board did not err in retaining jurisdiction over the interference to decide the patentability of Gartside's claims.

C. The Patentability of Claims 34, 35, 37-40, 42-44 and 47

Gartside argues that the Board erred in holding claims 34, 35, 37-40, 42-44, and 47 unpatentable under § 103, because the references do not teach or suggest the claimed invention. Gartside principally contends that the '645 and '235 patents are directed to thermal cracking processes, and that there was no suggestion in the art to employ a quench step in catalytic cracking processes. Gartside further asserts that the '235 patent teaches away from employing a quench in catalytic cracking. The Commissioner responds that the claims would have been obvious over Gartside's '645 and '235 patents, as those references contain each and every element of the claimed processes. The Commissioner argues that one of ordinary [\*1319] skill in the art would have been motivated to [\*\*37] combine the '645 and '235 patents, as they both attempt to solve the same problem, *viz.*, continued thermal cracking of the cracked product. The Commissioner also contends that the '235 patent does not teach away from employing a quench in catalytic cracking.

A claimed invention is unpatentable as obvious "if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains." 35 U.S.C. § 103(a) (1994); see Dembiczak, 175 F.3d at 998, 50 U.S.P.Q.2D (BNA) at 1616. "The ultimate determination . . . whether an invention is or is not obvious is a legal conclusion based on underlying factual inquiries including: (1) the scope and content of the prior art; (2) the level of ordinary skill in the prior art; (3) the differences between the claimed invention and the prior art; and (4) objective evidence of nonobviousness." Dembiczak, 175 F.3d at 998, 50 U.S.P.Q.2D (BNA) at 1616 (citing Graham, 383 U.S. at 17-18, 148 U.S.P.Q. (BNA) at 467). We have [\*\*38] further indicated "that the best defense against the subtle but powerful attraction of a hindsight-based obviousness analysis is rigorous application of the requirement for a showing of the teaching or motivation to combine prior art references." 175 F.3d at 999, 50 U.S.P.Q.2D (BNA) at 1617. That suggestion may come



from, inter alia, the teachings of the references themselves and, in some cases, from the nature of the problem to be solved. See *Pro-Mold & Tool Co. v. Great Lakes Plastics, Inc.*, 75 F.3d 1568, 1573, 37 U.S.P.Q.2D (BNA) 1626, 1630 (Fed. Cir. 1996); *Rouffet*, 149 F.3d at 1355, 47 U.S.P.Q.2D (BNA) at 1456.

We agree with the Commissioner that substantial evidence supports the Board's factfinding and that the Board correctly concluded that the claims were unpatentable under § 103. As an initial matter, we agree with the Commissioner that substantial evidence supports the Board's finding that Gartside's '645 and '235 patents contain all the limitations set forth in claim 47. See Gartside, Paper No. 72 at 12-13. The Board found that all the limitations of claim 47 are found in the '645 patent, except that the '645 patent accomplishes cracking by a thermal rather [\*\*39] than a catalytic mechanism. See Gartside, Paper No. 72 at 13. This finding is clearly supported by the following disclosure in the '645 patent:

The reaction proceeds at 1500 degrees F for a residence time of about 0.05 to 0.40 seconds, preferably from [sic] 0.20 to 0.30. The product gases are separated from the solids in separator 8 . . . and the product gases pass overhead through a line 22 and are immediately quenched with typical quench oil that is delivered to line 22 through line 36. The quenched product is passed through a cyclone 24 where entrained solids are removed . . .

'645 patent, col. 2, l. 62 to col. 3, l. 2. The Board found the missing limitation in the '235 patent, which teaches that the claimed apparatus may be used in catalytic cracking processes involving quenching and separation steps as in claim 47. See Gartside, Paper No. 72 at 13 (citing '235 patent, col. 4, ll. 42-47). Based on the foregoing, we conclude that the Board's finding that all of the limitations of the claimed invention are found in Gartside's '645 and '235 patents is supported by substantial evidence.

Gartside further contends that the [\*\*40] Board erred in finding that sufficient motivation existed to combine the '645 and '235 patents to arrive at the invention in claim 47. See id. at 14. We disagree. As the Board indicates, the '645 patent addresses the problem of hot particulate solids continuing [\*1320] to crack the product after the desired thermal cracking reaction has been completed, solving that problem by applying a quench after primary separation of cracking particles from the product. See Paper No. 72 at 14-15. The Board further

found that the '235 patent suggests that the presence of either hot thermal or hot catalytic solids in the product stream may cause undesired cracking. See id. at 15 (citing '235 patent, col. 1, ll. 6-10). These disclosures provide substantial evidence supporting the Board's finding that one of ordinary skill in the art would have been motivated also to apply the teachings of the '645 patent relating to arresting undesired cracking in thermal processes to minimize undesired cracking in catalytic cracking processes.

Gartside also asserts that the '235 patent teaches away from applying the process disclosed in the '645 patent to catalytic reactions. This contention is without merit. [\*\*41] Gartside cites the following language from the '235 patent:

In some reaction systems, specifically catalytic reactions at low or moderate temperatures, quench of the product gas is undesirable from a process standpoint. In other cases, the quench is ineffective in terminating the reaction. Thus, these reaction systems require immediate separation of the phases to remove catalyst from the gas phases. Once the catalyst is removed, the mechanism for reaction is no longer present.

'235 patent, col. 1, ll. 49-56. As the Board found, however, this portion of the specification addresses the undesirability of a quench used in catalytic reactions at low to moderate temperatures, not the high temperature reactions at issue in the '645 patent, and teaches that in other undefined systems, quenching is ineffective. See Gartside, Paper No. 72 at 16. That is not a clear "teaching away" from use of a quench in all catalytic systems. Accordingly, substantial evidence supports the Board's finding that this disclosure does not teach away from the claimed invention. See id. at 16-17.

Having concluded that the Board's factual findings relating to its § 103 analysis are supported [\*\*42] by substantial evidence, we further conclude that the Board did not err as a matter of law that claims 34, 35, 37-40, 42-44 and 47 are invalid as obvious. We have carefully considered Gartside's additional arguments but find them unpersuasive.

#### D. Patentability of Claims 41, 45 and 46

Gartside argues that the Board erred in its sua sponte holding that claims 41, 45, and 46 are unpatentable under § 103 based on the '645 patent in view of the Castagnos



patent, or on those two patents in view of the '235 patent. Gartside contends that the Board erred in combining those patents, because there was no teaching or suggestion to use a 0.1 to 0.6 second kinetic residence time in a catalytic cracking process. Gartside further argues that his showing of unexpected results, as described in the second Johnson Declaration, constitutes a secondary consideration weighing in favor of nonobviousness, and that the Board erred in discounting those results. The Commissioner responds that the Board correctly held that the claims were unpatentable, arguing that the motivation to combine the references arose from the references themselves, as well as the nature of the problem to be solved, [\*\*43] viz., maximizing reaction conditions in cracking processes by minimizing residence time. The Commissioner further contends that Gartside's evidence of unexpected results is not probative of nonobviousness, as the examples disclosed in the second Johnson Declaration do not correspond to any process within the scope of the claims at issue.

We agree with the Commissioner that substantial evidence supports the Board's [\*1321] finding that a motivation to combine the '645, '235, and Castagnos patents arose from the teachings of the references themselves and the nature of the problem to be solved. n10 As the Board found, use of low residence times to arrest undesired cracking in the '645 and '235 patents was part of a "trend in the art towards short residence times." Gartside, Paper No. 72 at 27; see '645 patent, col. 1, ll. 61-67 (disclosing residence times of between 0.05 to 0.4 seconds); '235 patent, title ("LOW RESIDENCE TIME SOLID-GAS SEPARATION DEVICE AND SYSTEM") and col. 7, ll. 26-31 (disclosing that adjustment of the claimed apparatus may yield residence times of 0.1 and 0.5 seconds). In view of this trend, one of ordinary skill who was attempting to minimize undesired cracking [\*\*44] reactions would have been directed by these two patents to the Castagnos patent, which describes low residence time catalytic reactions and which discloses the precise residence time in the disputed claims. See Castagnos patent, col. 2, ll. 6-12 (disclosing residence times of "about 0.1 to about 1 second"). Accordingly, we conclude that substantial evidence supports the Board's finding that a motivation existed to combine these patents to obtain the invention claimed in claims 41, 45, and 46.

n10 The Board did not perform a separate "motivation to combine" analysis, but incorporated the reasoning from its conclusion that claims 41, 45, and 46 were not patentably distinct from Gartside's other claims that corresponded to the count. See Gartside, Paper No. 72 at 25-29.

Gartside also argues that the Board erred in finding that the second Johnson declaration, which allegedly contains evidence of unexpected results, n11 did not weigh in favor of the patentability of claims 41, 45, and 46. We disagree. The [\*\*45] Board essentially adopted the APJ's order to show cause as it pertained to the second Johnson declaration, finding that the process recited in the declaration failed to reproduce the separation and quenching steps of the claimed process. See Gartside, Paper No. 72 at 35-36. This finding is supported by the declarant's own statements, which reveal that the quench in the declaration experiment preceded the separation of product from catalyst. See Paper No. 48 at 3, P 9. Accordingly, we agree with the Commissioner that substantial evidence supports the Board's finding that the examples in the declaration do not correspond to any process within the scope of the claims, and the declaration is therefore not probative of nonobviousness. See Gartside, Paper No. 72 at 35-36.

n11 According to the second Johnson declaration, these unexpected results include a 5% increase in gasoline yield and considerably less undesired dry gas and liquefied petroleum. See Paper No. 48 at 8, PP19-21.

In summary, we conclude [\*\*46] that all of the Board's disputed factfindings are supported by substantial evidence and that the Board did not err as a matter of law in holding that claims 41, 45, and 46 are invalid under § 103. n12

n12 We will only briefly note Gartside's contention that the Board erred in even addressing the patentability of these claims. We agree with the Commissioner that the Board properly upheld the APJ's denial of Gartside's motion to redesignate these claims as not corresponding to the count. See Gartside, Paper No. 72 at 28. In short, we agree with the Board that these claims are not patentably distinct from the other claims corresponding to the count for the same reasons that these claims are unpatentable under § 103.

#### CONCLUSION

The Board did not err in maintaining jurisdiction over the interference proceeding despite the withdrawal of the junior party, and further did not err in deciding the patentability of Gartside's claims that corresponded to the count. To the extent that the Board's decision to resolve [\*\*47] the patentability issues surrounding claims 41, 45, and 46 under § 135(a) was discretionary, [\*1322]

the Board did not abuse its discretion. As for the patentability of claims 34, 35, and 37-47, all of the Board's disputed factual findings relating to its obviousness analysis are supported by substantial evidence, and we

find no error in the Board's conclusion that the claims are unpatentable as obvious as a matter of law.

Accordingly, we

AFFIRM.

LEXSEE

IN THE MATTER OF THE APPLICATION OF STEPHEN F. ROYKA AND  
ROBERT G. MARTIN

Patent Appeal No. 9092

UNITED STATES COURT OF CUSTOMS AND PATENT APPEALS

490 F.2d 981; 1974 CCPA LEXIS 200; 180 U.S.P.Q. (BNA) 580

February 7, 1974, Decided.

**PRIOR HISTORY:** [\*\*1] Serial No. 648,701.

**CASE SUMMARY:**

**PROCEDURAL POSTURE:** Appellants sought review of a decision of the U.S. Patent Office Board of Appeals that affirmed the rejection of appellants' patent claims for a printed matter self-testing system as obvious under 35 U.S.C.S. § 103 and anticipated under 35 U.S.C.S. § 102.

**OVERVIEW:** Appellants designed an answer sheet for use in self-testing that featured a response area having legible, confusing information in erasable printing imposed over answers in permanent printing. The claims were rejected as anticipated by prior art under 35 U.S.C.S. § 102 and as obvious under 35 U.S.C.S. § 103. The court reversed, finding that the superimposed printing in appellant's response was legible and imparted information, which was not the case in the prior references. Therefore, the court held that a finding of anticipation was not warranted, as the claimed invention was not disclosed in the prior art. The court also noted that printed matter could constitute structural limitations upon which patentability could be predicated. The court found that the claims were not obvious for the same reasons they were not anticipated by prior art.

**OUTCOME:** The court reversed the Board's decision that rejected appellants' claims as obvious and anticipated. The court held that appellants' invention was sufficiently distinguished from prior art that it was neither anticipated by it nor obvious in light of it.

**CORE TERMS:** removable, permanent, invention, printing, confusing, legible, picture, scene, anticipated, column, anticipation, examiner, printed, sheet, xerography, toner, comprising, concealed, disclose, water, user, specification, disclosure, confuse, drawing, utilizes, hiding, media, fused, subject matter

**OPINIONBY:**

RICH

**OPINION:** [\*981]

RICH, Judge.

This appeal is from the decision of the Patent Office Board of Appeals affirming the examiner's rejection of claims 28 and 30-36 of application serial No. 648,701, filed June 26, 1967, entitled "Responsive Answer System." We reverse.

The Invention

The appealed claims are directed to a device in the nature of an answer sheet for use in self-instruction and testing. The answer sheet may be associated with questions or separate therefrom. The essential features of the invention are that there are printed on the answer sheet in "response areas" meaningful information in permanent printing and confusing information in printing which can be removed, as by an eraser, both being legible so that a student, seeing a choice of answers to a question, must make a selection. Having made a selection, he then ap-

plies as eraser to the selected response area and some of the information will be readily removed. What remains advises him of the correctness or otherwise of his answer. The following figures from the drawings are illustrative:

[Graphic omitted. See illustration in original.]

Fig. 1A shows two response areas [\*\*2] to a given question before any removing action [\*982] by the student has taken place and Fig. 1B shows the permanent information remaining in each after erasure of the removable information. Of course, if the student makes an initial choice of area A, showing up "YES" or some other indication of a correct answer, he will not need to proceed further and erase the B area. In a modified form of the invention, a wrong selection, plus erasure, may expose, instead of or in addition to a statement that the answer is wrong, a number or other reference to further material which is to be studied.

A preferred method of printing the permanent meaningful information and the removable confusing information is by that type of xerography in which a fusible toner is used, the permanence of the printing depending on the extent to which the toner image is "fixed" or fused by heat. By successive printings of the two kinds of information with fixing to different degrees, one image can be made permanent and the other made subject to easy removal, both images retaining such similarity of appearance that the user of the answer sheet cannot tell them apart.

Claim 28 is the principal claim, all [\*\*3] others being dependent thereon, and reads as follows:

28. A device for selectively indicating information comprising

a support having response areas for presenting information for selection,

permanent printing indicative of meaningful information permanently fixed to said support within a response area, and

removable printing indicative of confusing information removably fixed to said support within a response area,

said meaningful and confusing information being substantially legible even when said permanent and removable printing are fixed over one another on said support,

said permanent and removable printing being substantially similar such that an observer cannot determine which information is permanent and which is removable

whereby the information within a response area is selected by attempting to remove the printing therein with the failure to remove printing identifying meaningful information.

Claims 30-36 add limitations which need not be considered except for noting that claims 33 and 34 alone specify the use of a xerographic toner, for which reason they were rejected on a different ground from the other claims.

#### The Rejection

The following references [\*\*4] were relied on:

[SEE TABLE IN ORIGINAL]

Claims 28, 30, 31, and 32 were rejected as anticipated under 35 USC 102 by Bernstein; claims 28, 31, 32, 35, and 36 were rejected as anticipated under § 102 by Reid; and claims 33 and 34 were rejected under 35 USC 103 for obviousness, on either Bernstein or Reid in view of Lein. These were the examiner's rejections and the board affirmed them, adhering to its decision on reconsideration.

Bernstein discloses an answer sheet in which printed information representing a response is "temporarily concealed from the observer" and he discloses a number of different ways of effectively concealing the response. His specification states:

The objects of the invention are accomplished by utilizing the hiding media to confuse the participant and to render the response and the hiding media indistinguishable and thus conceal the presence, absence, nature or position of the response from the participant. This may be effectuated by careful attention being paid to a number of factors including the design, [\*983] color and position of the hiding or confusing media.

Fig. 1 of Bernstein's drawings illustrates some of his concealing means: [\*\*5]

[Graphic omitted. See illustration in original.]

The following is the written description:

Referring now to the drawing, FIG. 1 illustrates some of the many optically confusing patterns which may be positioned between the printed structure to be concealed and the point of observation. Column 11 shows the information which is to be concealed. This information is repeated in columns 12 through 16 but in each case is concealed by a pattern in accordance with the present invention. Column 12 utilizes a pattern comprising an alphabetical maze in both line and half tone screen. Column 13 utilizes a pattern comprising an absorbing field having a plurality of irregular dot-like interstices. Column 14 utilizes a pattern comprising a maze

of plus signs combined with dots. Columns 15 and 15 illustrate irregular and non-repetitious patterns. Bernstein says that if at least 50% of the response is actually covered by the opaque portions of the confusion pattern, complete concealment is obtained. He also says that added means of concealment may be used, such as scoring and embossing and perforating the paper in order to scatter the light or let it shine through.

Reid is entitled [\*\*6] "Transformation Picture and Print." The invention is said to be useful for advertisements, Christmas cards, birthday cards, valentines, and the like and as a source of amusement and instruction for children. It consists of a picture or print, part of which is permanently printed and part of which is removable from the paper on which it is printed. For the latter various soluble undercoatings or inks are described. If the picture is washed with a solvent, which may be water, the removable part disappears and the pictorial and/or typographic matter changes. The invention is illustrated by a typical nineteenth century temperance propaganda piece depicting the evils of drink. In the finished picture there are three scenes from left to right: Scene 1, the innocent child leads her father home from the pub; Scene 2, Father sits slumped in the kitchen chair with his bottle beside him, the family wash hanging above his head, this picture being entitled "The Effects of Drink"; Scene 3, Mother stands in front of a sign reading "Pawn Shop." Across the bottom of the picture is a legend which says "Wash the above and see what water will do." Fig. II shows the result of washing with water: Scene [\*\*7] 1, a handsome young man and his happy daughter stroll on the street; Scene 2, Father sits erect in a well-appointed room at a cloth-covered table, apparently having a cup of tea, obviously a gentleman; Scene 3, Mother beams from the sideline and the Pawn Shop sign has vanished. Two new subscriptions appear and the words "The" and "Drink" have disappeared, the resultant being a new picture title reading "The Beneficial Effects of Temperance." "The Beneficial" and "Temperance" were covered by some soluble opaque in the original picture. No doubt the overall effect is instruction. Perhaps there was amusement in bringing about the transformation.

Lein relates to xerography and is relied on only for its disclosure of the removability of partially fused toner and the permanence of fully fused toner.

#### OPINION

As to the § 102 anticipation rejections, it will suffice to consider independent claim 28. If it is not fully met by Reid [984] or Bernstein, neither are the more limited dependent claims. It is elementary that to support an anticipation rejection, all elements of the claim must be found in the reference. We do not find claim 28 anticipated by Bernstein because, as [\*\*8] we read the

claim, it requires the display of legible meaningful and legible confusing information simultaneously, between which the user of the device may make a selection before he undertakes to remove any of the information from the response area selected by him. The element we find most clearly missing, contrary to the reasoning of the examiner and the board, is the legible confusing information. The Patent Office proposes to read this limitation on Bernstein's confusion patterns which are nothing but meaningless obscuring screens, conveying no information and providing the user with no basis for making a selection, as called for by claim 28. In appellants' device the legible confusing information - i.e., the wrong answers - are legible in the sense that they can be read as intelligible words, not merely a jumble of type serving to obscure the words of the wrong answers.

Appellants were fully aware of Bernstein and discussed its disclosures in their specification, distinguishing from this and other prior art, saying, in part:

The inventive concept hereof confuses not by physical blocking as taught by the prior art, but by compounding, associating (including disarranging) [\*\*9] permanent information with confusing information, usually at least some of which is similar in character to the permanent information as to render it impossible to tell which is permanent and which is removable confusing information. In the invention, generally no attempt is made to designedly physically cover the permanent information, but to confuse it beyond interpretation by the presentation of extraneous removable, confusing information.

Claims are not to be read in a vacuum and while it is true they are to be given the broadest reasonable interpretation during prosecution, their terms still have to be given the meaning called for by the specification of which they form a part. We cannot read the terms "legible" and "information" on Bernstein's confusion patterns, as did the examiner and the board. They are not "legible," as appellants use the term, and they convey no information.

As to anticipation by Reid, we find neither appellants' basic concept nor the substance of claim 28 to be disclosed. Apparently the solicitor could find little to support the rejection in Reid for all he says in his brief - so far as claim 28 is concerned - is:

Reid discloses a sheet which may [\*\*10] be used for instruction and which may have a removable design partly covering a fixed design \* \* \*. Therefore, the disclosure of the reference encompasses the arrangement wherein a removable design covers a fixed design with both designs being substantially legible.

But claim 28 does not call for an arrangement wherein a removable design covers a fixed design. It

calls for response areas, which Reid does not have, containing meaningful information in permanent printing together with removable printing conveying confusing information, both legible at the same time, between which a "selection" can be made. The only choice offered to the user by Reid is to follow the instruction to wash the whole visible picture with water or other solvent, thus removing the over-printing, to discover what the permanent picture is. The Patent Office attempt to read claim 28 on this reference is a tour de force. We hold that Reid does not anticipate for failure to meet the limitations of claim 28 to "response areas," to the presentation of two categories of information (meaningful-permanent and removable-confusing) within such areas, and the possibility of selection. Anticipation requires a finding [\*\*11] that the claimed invention be disclosed. It is not enough to say that appellants' invention and the reference are [\*985] both usable for instruction and both consist of permanent and removable printings on paper, as did the solicitor.

The dependent claims rejected with claim 28, as anticipated under § 102, are not anticipated since claim 28 is not anticipated. Some of them merely add features which are disclosed by the references and some do not. Insofar as they do not, they further negative anticipation. The examiner recognized this fact as to claims 33 and 34, which are limited to xerography, and therefore did not reject them under § 102. Similarly, he did not reject claim 30 on Reid or claims 35 and 36 on Bernstein. We find that claims 35 and 36 contain limitations which additionally distinguish from Reid. We have already noted that Reid has no "response areas" as required by claim 28 and so Reid does not disclose the structure of claim 35 which additionally requires both the correct

and incorrect answers to appear within the same response area.

As to claim 36, the examiner said it "is merely a printed matter variation of the design of the reference," Reid. This [\*\*12] is not a valid reason for rejection. Printed matter may very well constitute structural limitations upon which patentability can be predicated. We have commented on this matter in *In re Jones*, 54 CCPA 1218, 373 F.2d 1007, 153 USPO 77 (1967); and *In re Miller*, 57 CCPA 809, 418 F.2d 1392, 164 USPO 46 (1969), and will not repeat ourselves. The limitations of claim 36 are not remotely suggested by Reid.

There remains the § 103 rejection of claims 33 and 34. Do they, taken together with all of the limitations of claim 28 from which they depend, define obvious subject matter? The difference between claim 28 and these two dependent claims is that they add the limitations to xerography. If Bernstein and Reid showed the claimed invention except for xerography, the addition of the Lein reference would make the subject matter of the claims obvious. But that is not the situation here. Adding the knowledge of xerographic technology to Bernstein or Reid still does not make the invention of claims 33 and 34 obvious for the same reasons we have given above in discussing anticipation. The essence of appellants' invention, as set forth in claim 28, is still missing notwithstanding the addition [\*\*13] of the Lein reference and we see nothing in the combinations of references which would have made the invention obvious to one of ordinary skill in the art at the time it was made. We will, therefore, reverse this rejection.

The decision of the board is reversed.

REVERSED